2023 Project Summit

October 24, 2023

CalNEXT
ENERGIZING CALIFORNIA'S FUTURE

AGENDA

10 AM – 10:05 AM PT
Intro to CalNEXT

10:06 AM – 10:43 AM PT
Intro to HVAC and Water Heating TPMs
HVAC and Water Heating Projects
Q&A

10:45 AM - 11:24 AM PT
Intro to Whole Building and Process Loads TPMs
Whole Buildings and Process Loads Projects
Q&A

11:25 AM - 12:00 PM PT
Intro to Plug Loads and Appliances and Lighting TPMs
Plug Loads and Appliances and Lighting 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

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

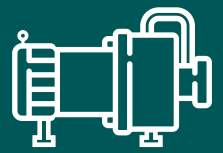
Focused Pilot (FP): mapping end-to-end barriers of high-impact technologies (based on the Focused Pilot TPM)

Technology Priority Maps

Appliances & Plug Loads

HVAC

Lighting



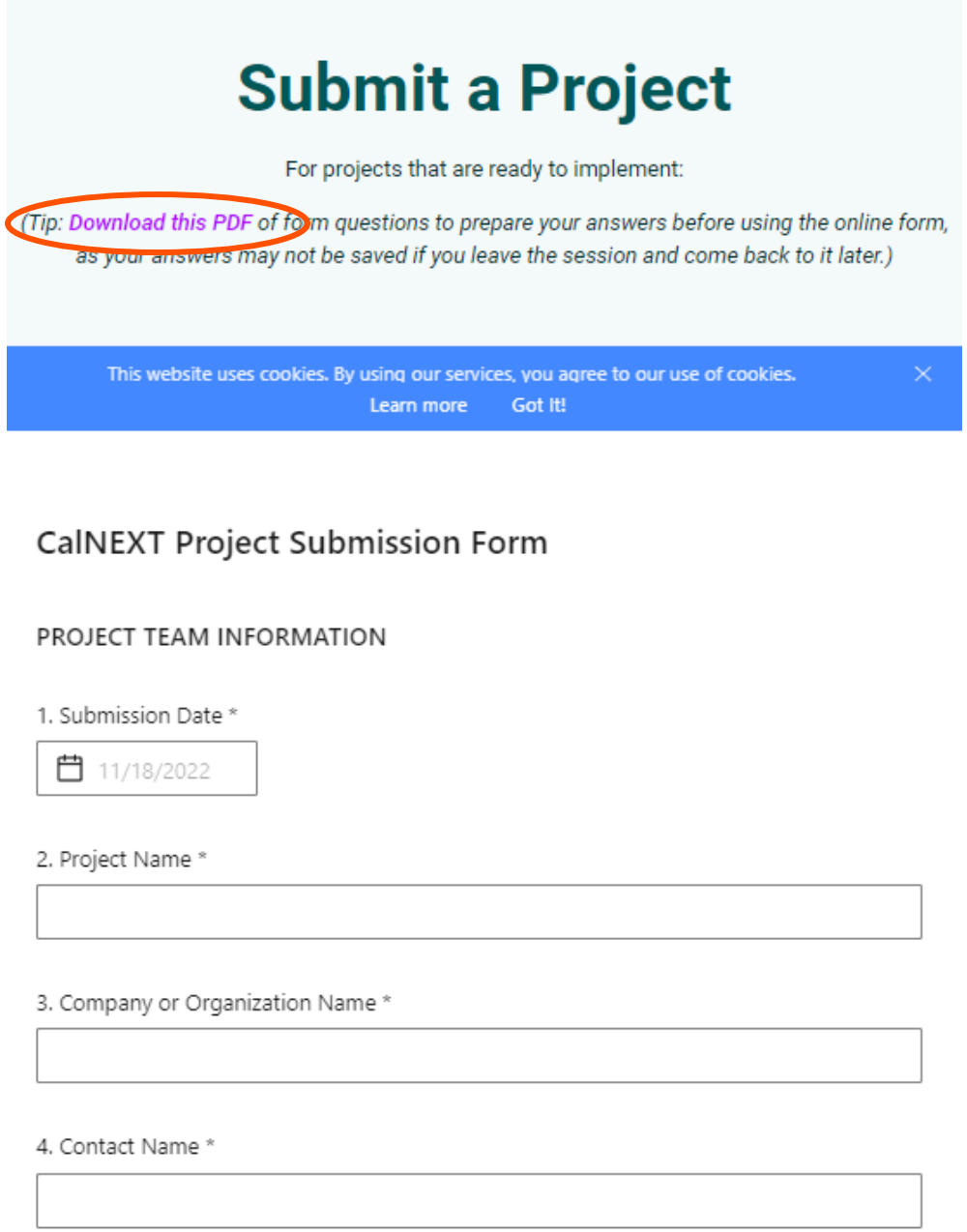
Process Loads

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: Nov 30



Presenters

Amin Delagah
Associate Director
TRC

Brian Picariello
Senior Consultant
VEIC

Cassidee Kido
Senior Project Manager
Energy Solutions

Curtis Harrington
Senior Research Engineer
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Energy Solutions

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2022 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:

- High-Efficiency Heat Pumps for Space Heating and Cooling
- Scalable HVAC Controls Deployment
- Hybrid or Fully Compressor-less HVAC
- Heat Pump Market Transformation
- HVAC Design for Decarbonization
- Scalable Thermal Storage
- Installation, Operations, & Maintenance
- 110V/120V Heat Pumps (portable, room, and packaged thermal HPs)
- Refrigerant Management & Low GWP Transition

2022 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 moment 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:

- Residential-Duty Water Heaters
- Commercial-Duty Water Heaters
- Grid Integration & Market Intervention
- Alternative Design Strategies

HVAC and Water Heating

- **ET22SWE0034** - Hybrid Heat Pump and Indirect Evaporative Cooling Packaged Unit (Hybrid RTU)
  - Dave Vernon, UC Davis

- **ET22SWE0052** - Swimming Pools as Heat Sinks
  - Curtis Harrington, UC Davis

- **ET22SWE0019** - Market Potential for Heat Pump Assisted Hot Water Systems in Food Service Facilities
  - Amin Delagah, TRC

- **ET22SWE0048** - Commercial Kitchen Hot Water System Design Guide
  - Amin Delagah, TRC

- Q&A

ET22SWE0034

Hybrid Heat Pump and Indirect Evaporative Cooling Packaged Unit (Hybrid RTU)

David Vernon, UC Davis

TPM Domain: HVAC

Technology Family: Hybrid or Fully Compressor-less HVAC

Project Type: Lab Test

Efficiency Programs: Commercial Programs

Executive Summary

Lab test of Heat Pump and Indirect Evaporative Cooling Packaged Unit (Hybrid RTU) for commercial buildings. The goal is to produce energy performance curves for EnergyPlus and CBECC-Com to enable energy savings estimates for future measrue development and code compliance.

Energy performance curves will be used in future new measure development.

Opportunities

Adding separate Indirect Evaporative Cooler (IEC) equipment to a typical rooftop packed unit (RTU) can save over 50% of cooling power.

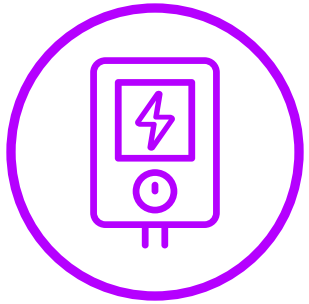
The Hybrid RTU combines the IEC with a heat pump in one packaged unit that has integrated controls making sizing, installation, and commissioning easier.

Existing IEC products are typically separate units added onto standard RTUs, requiring designers to correctly size both units and modify RTU controls.

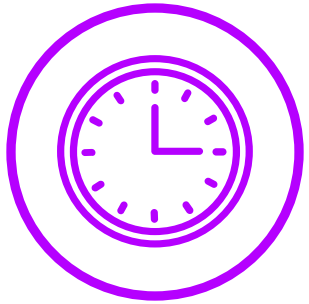
Project Timeline

The lab test plan, environmental chamber modification, equipment setup and instrumentation are complete.

- Need to estimate Hybrid RTU energy savings



- Develop Hybrid RTU energy performance curves for new measure development



- Hybrid RTU energy performance curves can also be used in future codes and standards enhancement

Next Steps

Complete lab testing and analyze data to develop performance curves for Energy Plus and CBECC-Com

Future projects will:

- Develop a new Hybrid RTU measure package
- Field test Hybrid RTU for case study

Thank you

David Vernon, UC Davis

Info@calnext.com

ET23SWE0052

Swimming Pools as Heat Sinks for Air Conditioners

Curtis Harrington, UC Davis

HVAC

High-Efficiency Heat Pumps for Space Heating and Cooling, Pool Heating

Support new custom measure development

Field Evaluation

Executive Summary

This project is evaluating a technology that allows waste heat from an air conditioner to be rejected to a swimming pool. Two demonstrations of the technology are being performed where performance data is being collected. This data will be used to determine the energy performance of the retrofits, as well as validate a model for predicting energy savings in different applications. The tool being developed can support a measure development around the technology.

The audience for this work is intended for utility program administrators.

Opportunities

- Air conditioning energy savings of ~10-15%
- Air conditioning savings of 30% or more during hot conditions (over 95°F)
- Consistent capacity and power draw during all outdoor air conditions
- Provides “free” pool heating for improved comfort

This project is:

- Validating performance of the technology
- Documenting installation process
- Providing tool for utilities to predict savings in other applications and climate zones

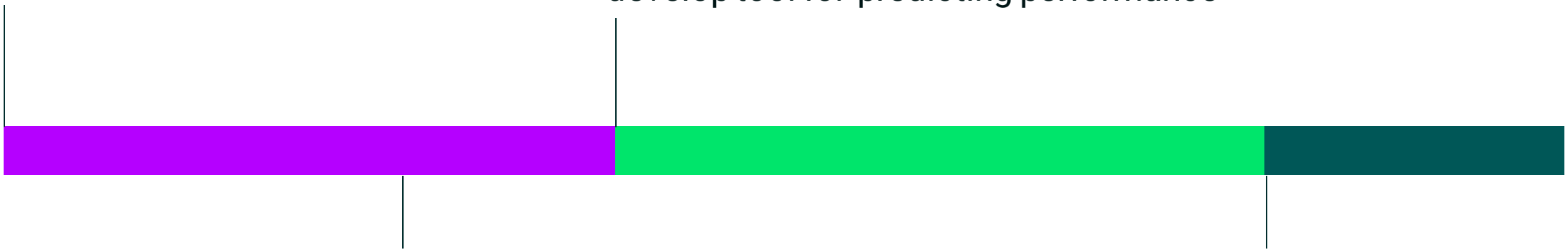
Project Timeline

May 2023 - Baseline monitoring

Install baseline monitoring equipment

Sep. 2023 - Savings tool development

Analyze results from demonstration and develop tool for predicting performance



Aug. 2023 - Retrofit install

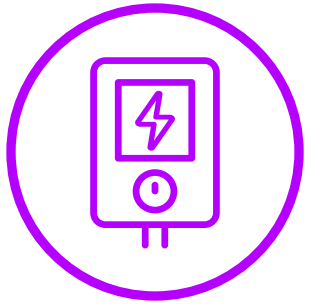
Perform retrofit and continue post retrofit monitoring

May 2024 – Final reporting

Generate final report outlining retrofit performance and technology savings tool

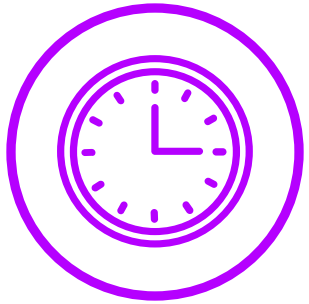
Primary barriers:

- No prior studies of technology
- Retrofit challenges (contractors are not familiar)
- Energy savings is hard to estimate



This project will:

- Evaluate performance on two installations
- Develop energy savings calculator tool
- Provide recommendations to utilities for potential program implementation



Project does not directly influence codes and standards

Next Steps

Next steps:

- Evaluate field results
- Develop energy savings estimator tool
- Estimate performance of system in different climate zones

The Final Report is not complete for this project. The information in the Final Report, along with the energy savings tool, will inform the development of a utility program.

Thank you

Curtis Harrington, UC Davis

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CalNEXT

ET22SWE0019

Market Potential for HP Assisted Hot Water Systems in Foodservice Facilities

Amin Delagah, TRC

Water Heating

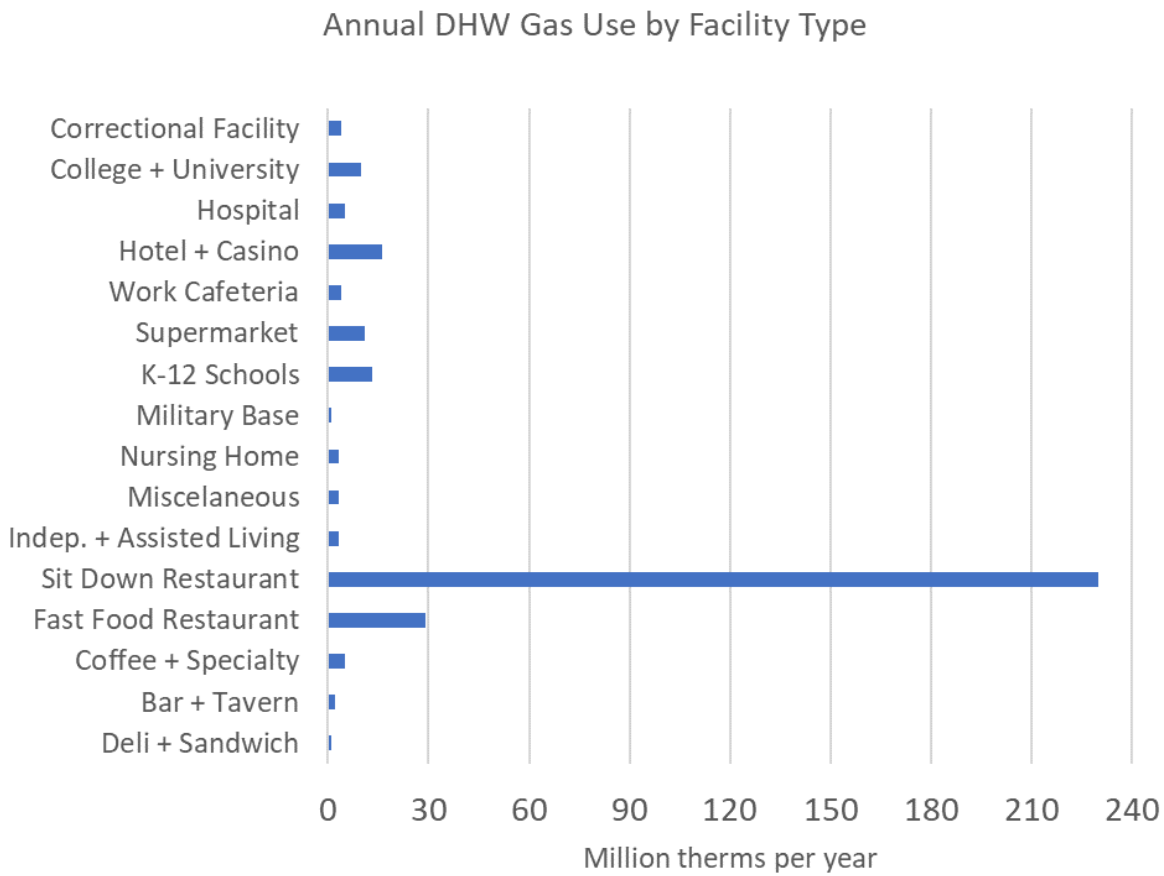
Commercial-Duty Water Heaters

Technology/Program Support

Market Study

Executive Summary

- Water heating in commercial kitchens is 90% gas-fired with the remaining 10% using electric resistance
- No heat pump installations identified in California restaurants based on literature reviews and interviews
- **Multiple barriers** identified including:
  - Have higher upfront costs (equipment, design, installation, electrical upgrades)
  - Have higher space and water storage requirements (footprint, weight)
  - Broad lack of familiarity with technology and application with owners
  - HP source and site energy savings doesn't typically yield operating cost savings



Source: 2010 CEC Report by Fisher-Nickel Inc.
https://hdl.handle.net/2027/uc1.31822039658588

Executive Summary

- Biggest barriers identified is state health department water heater sizing guidelines
  - No sizing guideline for heat pumps, only gas-fired and electric resistance
  - Electric resistance WH thermal efficiency of 0.98 is used to calculate kW input (power)

Formula 2 (for electric water heaters):

$$KW\ input = GPH\ X\ °F\ Rise\ X\ \frac{8.33lb}{gallon\ of\ water} \div Thermal\ Efficiency^{1}\ X\ 3412\frac{BTU}{KW}$$

KW input = 54 GPH X 50°F X 8.33 lbs / 0.98 X 3412 BTU/KW = 6.7 KW

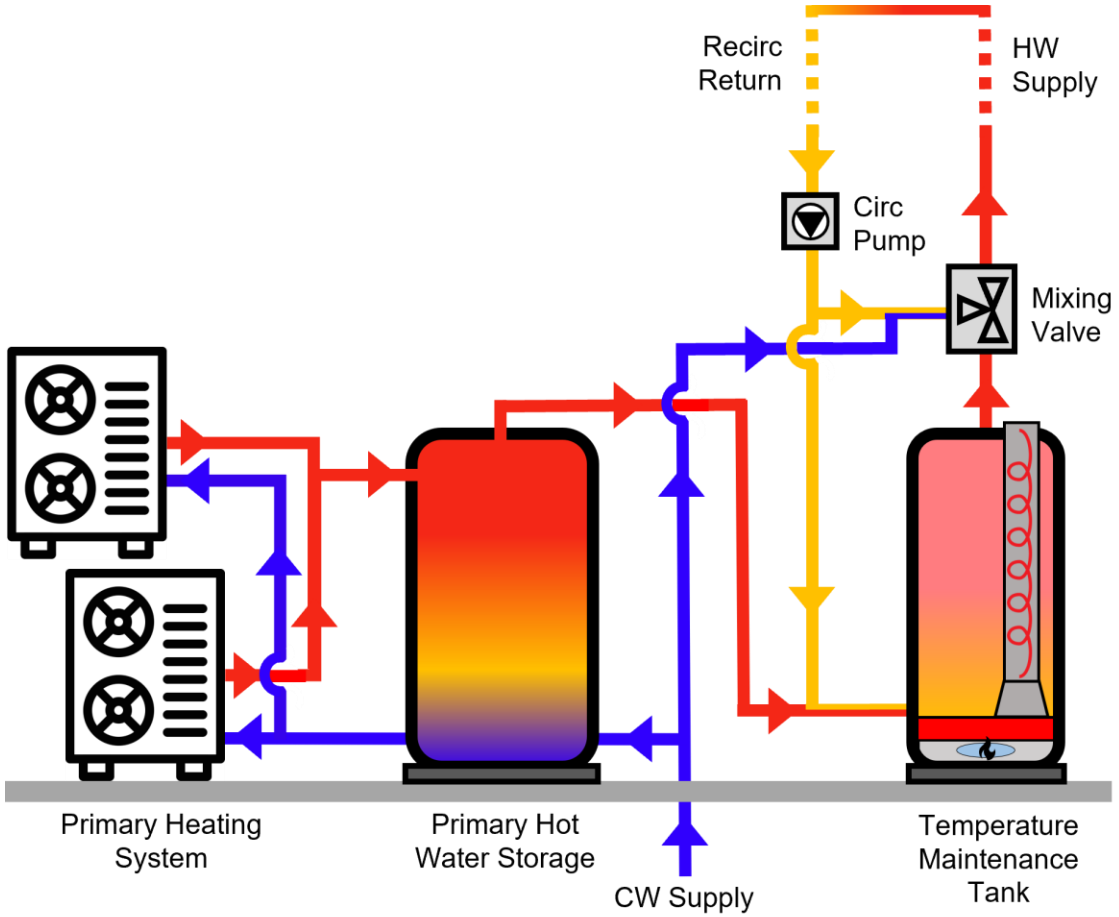
Source: CCDEH

  - If allowed to use Formula 2 by local jurisdiction, the HP is oversized by up to 400 percent
  - Existing sizing guidelines don't account for hot water storage capacity
- Report identified appropriate HP technologies for kitchens
- Concept of Heat Pump Assist developed to overcome existing water heater sizing guidelines

The intended audience are plumbing engineers, policy makers, incentive program developers, restaurant industry

Opportunities

- Using a heat pump and storage tank upstream, in series with the existing gas heater in an “assist” fashion, is one way to overcome water heater sizing barrier
- It also mitigates other barriers including installed and operating costs, electrical capacity limitations, familiarity, and footprint
- Adds resiliency with dual fuel capability
- Lowest operating costs: HP may be setup to only operate during off-peak periods between 9pm to 4pm, can be inactive when Flex Alerts or PSPS events occur

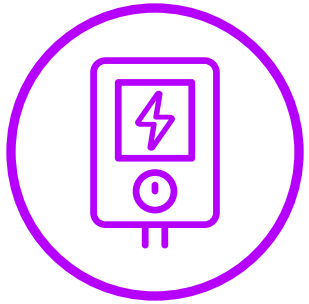


Opportunities

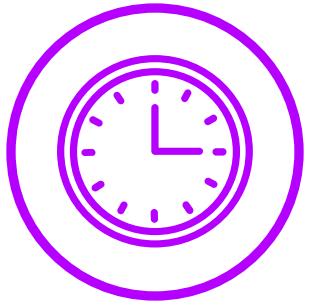
- In facilities with small hot water loads, there is a regulatory path to use light-commercial integrated HP/electric resistance heaters that meet electrical input power requirements of nominally 8 kW.

Photo Credit: A.O. Smith

- HP Assist systems allow for HPs to be incorporated into existing and new buildings today by using existing or backup electric resistance or gas-fired water heaters. Demonstration of HPs in commercial kitchens is a key step to the end goal of updating the sizing guidelines to include HPs and mitigating or eliminating other barriers.



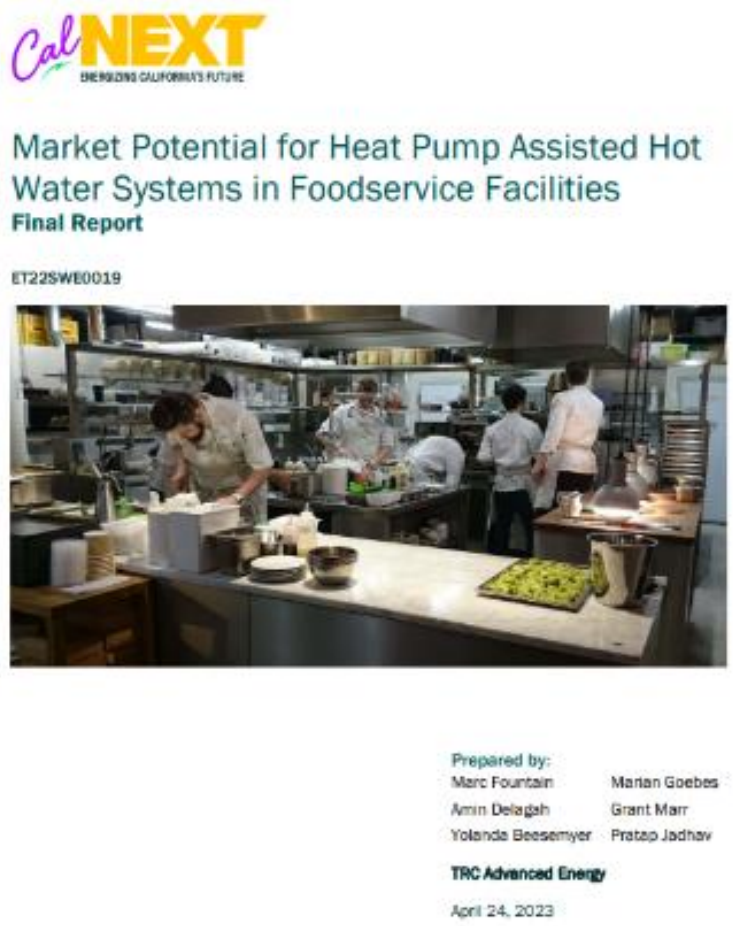
- This study has showed a pathway for incentive programs to overcome the sizing regulatory hurdle and move forward today to support purchase and installation of HPs in hybrid configuration in kitchens
  - Full replacement of existing heater with hybrid ER/HP integrated heater
  - Add on HP-Assist to existing gas or electric resistance heater



- This study has helped mobilize the statewide code readiness and C&S teams to identify and prioritize removal of the barriers to decarbonization with DHW systems in commercial kitchens by developing new initiatives

Final Report

- The project report can be found at https://calnext.com/wp-content/uploads/2023/07/ET22SWE0019_Final_Report.pdf.
- Concurrent CalNEXT projects include:
  - HP-Assist Field Retrofit Project in Sit Down Restaurant
  - Foodservice DHW System Design Guide and Operator's Guide
- This project has supported development of upcoming projects
  - CalNEXT code readiness project plans to overcome key barriers to electrification with DHW systems in foodservice
  - SF Environment Pilot HP demonstration project in SF restaurant in planning phase



Next Steps

- Develop HP incentive programs
- Counter trends in 2022 reach codes that include exceptions for foodservice facilities in their new building electrification code (see table)
- Develop code readiness initiatives
- Growing installed base of HPs in foodservice supports CARB, and South Coast and Bay Area AQMDs rulemaking efforts for zero emission (GHG, No_x) water heaters by 2031

City	Commercial Building Requirements
Glendale	New buildings all-electric with no exceptions; economic infeasibility provision applicable to commercial kitchens
Los Angeles	New buildings all-electric starting 2023, exceptions for commercial cooking
Pasadena	New mixed-use and commercial buildings (except medical-health care facilities, food service/commercial kitchens), multifamily buildings > 3 units to utilize electric energy only
Riverside	New buildings ≤ 3 stories with building permit on or after 1/6/2023, to be all electric; ≥ 4 stories with permit on or after 2026, to be all-electric; exceptions for commercial cooking
Santa Monica	New buildings all-electric starting 2023, exceptions for commercial cooking and medical facilities

Source: SCAQMD Rule 1146.2 Working Group Meeting #3

Thank You!

Amin Delagah

adelagah@trccompanies.com

ET22SWE0048

Commercial Kitchen Hot Water System Design Guide

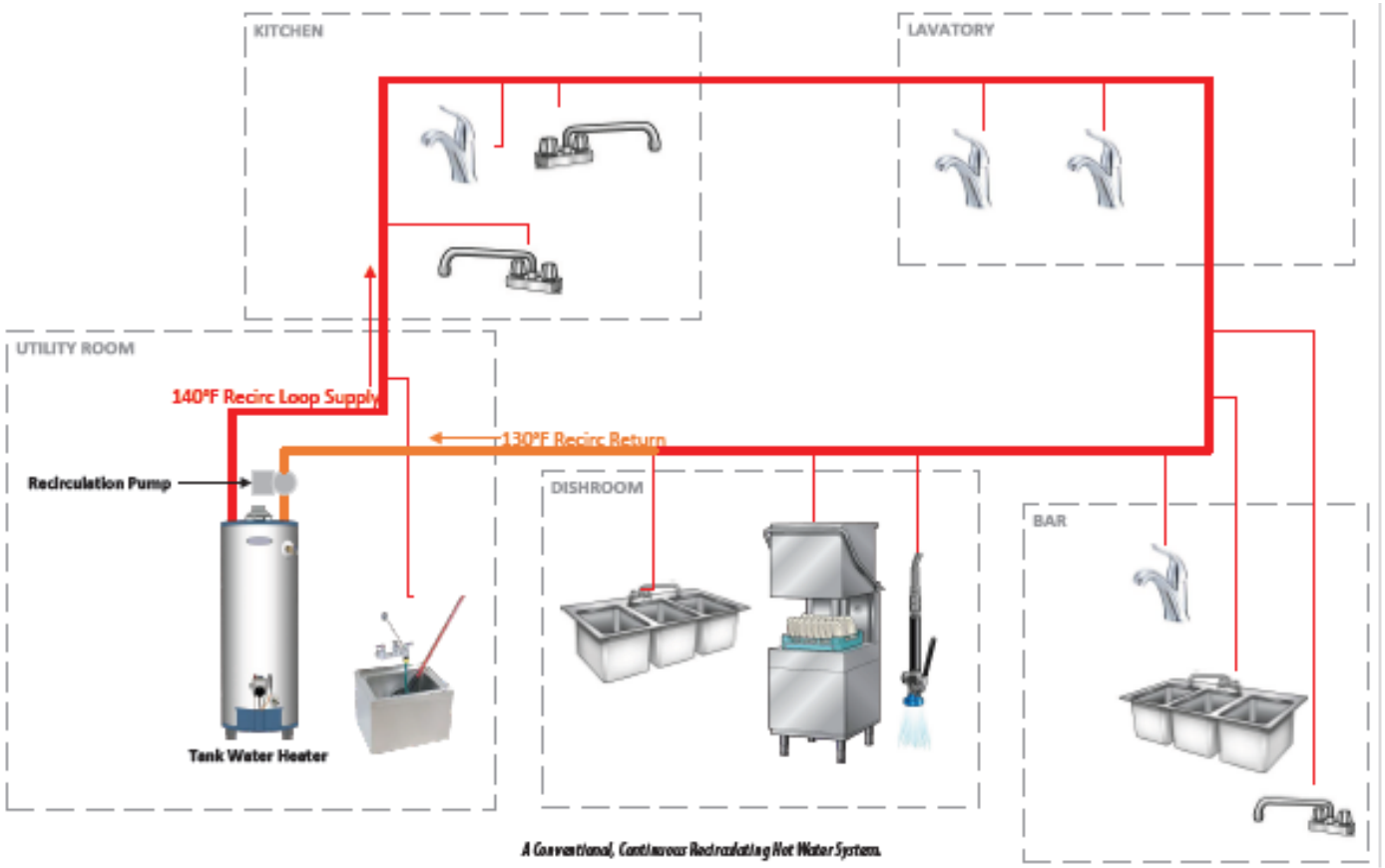
Amin Delagah, TRC

Water Heating

Commercial-Duty Water Heaters

Support Existing Workpaper

Tool Development/Enhancement



Executive Summary

Update and expand on existing commercial kitchen hot water system design guide with NG focus.

Split guide into two guides, a technical guide and operator's guide.

- Technical guide: Added HP Assist concept, mixing valves, water circulators and controls, expanded section on pipe insulation, electric HPs and HP installation and sizing considerations, load flexibility, water heater cost and footprint, and DHW system design examples in fast food (7) and sit-down (13) restaurants that incorporate source energy, installed cost, operating cost, payback period, and 10-year cost.
- Operator's guide: Focused on commissioning, operating, maintaining equipment and systems and specifying efficient equipment for replacement on burnout. Includes startup and shutdown checklists, leak costs, maintenance checklist.
- A slide deck accompanied by audio in English and Spanish and design guides will be translated into Spanish.

The intended audience are plumbing engineers and foodservice facility designers for technical guide, restaurant owners and operators for the operator's guide.

Opportunities

Restaurants are not aware of changes they can make to their hot water system at the heating plant, distribution system or at point of use that can improve hot water delivery performance and provide energy and operating cost savings.

This design guide identifies opportunities for utility programs to offer incentives on distribution system components such as pipe insulation, high-efficiency pumps and controls, and master mixing valves. Incentives can also be provided for cold water fed dishmachines with heat recovery systems, and heat pump water heaters.

This project focuses on developing design guides and presentations that serve as living educational tools to the foodservice industry to help achieve operating savings in an industry that is struggling to survive.

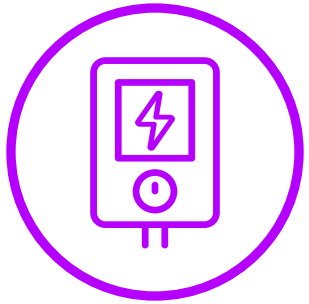
Decarbonizing restaurants is critical to state reaching climate goals and the design guide offers ways for restaurants to electrify their hot water system now while meeting health department water heater sizing regulations.

Prior to this project there was limited information on heat pump sizing, design and installation and operating cost information.

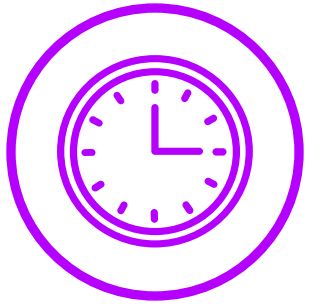
Project Timeline

Currently working on finalizing the technical design guide and draft slide deck and operators guide translation.

- The main barriers addressed where is it feasible to install HPs in existing buildings from a space perspective and if so, do electric and gas HPs payback.
- The answer is it depends.



- This project supports the statewide EE portfolio as it also educates incentive program developers to understand the complexity and challenges of DHW systems in kitchens and try to bundle incentives for a combination of equipment that will provide a payback for the owner/operator.



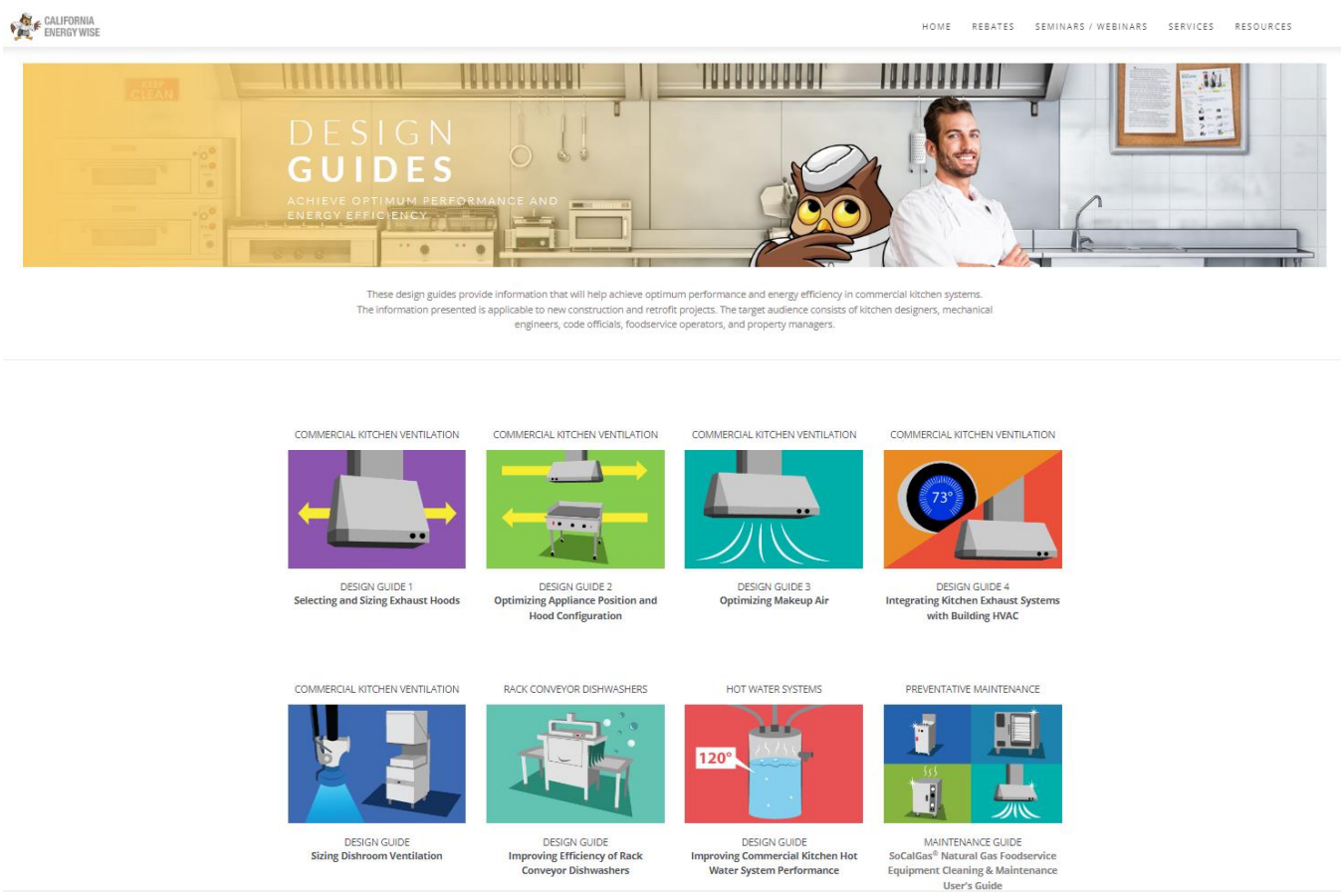
- These materials support code readiness and C&S activities by providing a solid foundation to understand the barriers and opportunities to decarbonizing hot water systems in commercial kitchens.

Final Report

Final report will be posted on CalNEXT website. https://calnext.com/approved-projects/

Design guides and slide decks with audio will be posted on California Energy Wise website. https://caenergywise.com/design-guides/

The findings can inform future code readiness work and future CalNEXT projects.



Next Steps

Incorporate feedback received from plumbing designers, manufacturers, and industry and finalize design guides.

Develop seminar slidedeck and audio.

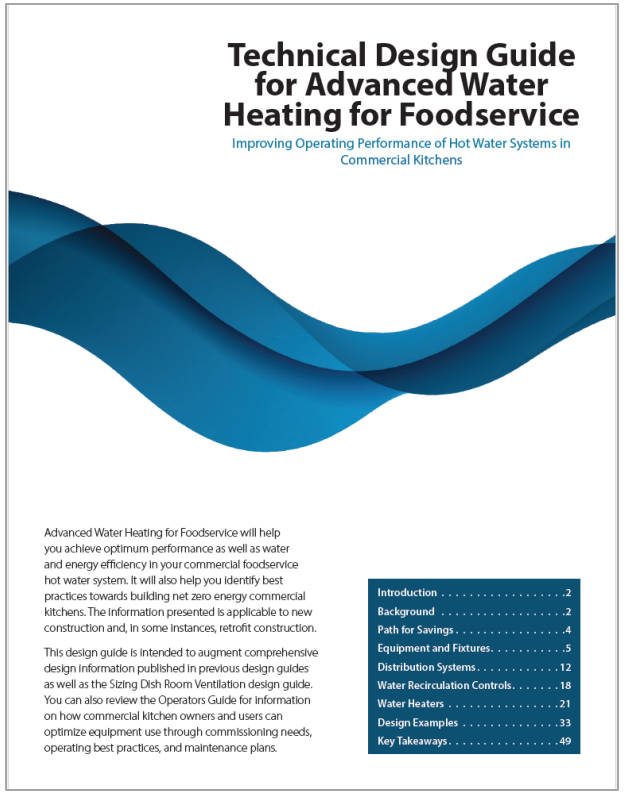
Translate all materials into Spanish.

Post online and disseminate materials via CalNEXT and CA Energy Wise websites.

Reach out directly through email to contact list of targeted audience and stakeholders.

The design guides are now through three major revisions in 13 years.

They design guides are living documents and will continue to educate the industry and hopefully will be updated in the future as we evolve with the design and operation of DHW systems.



Thank You!

Amin Delagah

adelagah@trccompanies.com

Poll 1


Q&A

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2022 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

2022 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 (energy efficiency or fuel substitution) and/or the establishment of new standards. Commercial Refrigeration is of particular interest as that sector is a large contributor to emissions and is transitioning to a low-global warming potential future.

Tech Families of this group include:

Cross-Cutting Category
- Advanced Motors
- Pumping Systems
- Heat & Hot Water Systems
- Process Heating Technologies
- Process Air Systems
- Smart Manufacturing Controls

Food Systems
- Indoor Agriculture
- Food Processing
- Restaurant & Food Equipment

Refrigeration
- Refrigeration, Commercial
- Refrigeration, Industrial

High Tech & Life Sciences
- Data Centers & Enterprise Computing
- Labs & Hospitals

Water Systems
- Water Systems

Vehicle Charging
- Off-Road Fleet Charging

Whole Building and Process Loads

- **ET23SWE0043 -** Residential High-Performance Windows Measure Package Development
  - Kyle Booth, Energy Solutions
- **ET22SWE0031 -** Wastewater Treatment SB1383 Compliance Characterization
  - Fernando Miramontes, AESC
- **ET22SWE0054 -** Foodservice Refrigeration: High Efficiency Condenser and Evaporator Units Focused Pilot
  - Rocco Sucato, Energy Solutions
- **ET22SWE0057 -** Market Study of Household Electric Infrastructure Upgrade Alternatives for Electrification
  - Brian Picariello, VEIC
- Q&A

ET23SWE0043

Residential High Performance Windows Measure Package Development – Fast Track

Kyle Booth, Energy Solutions

Whole Building Domain

Envelope

Measure Package Development

Residential Programs

Executive Summary

This project aims to develop a California deemed energy savings measure package for residential high efficiency windows.

California Decision 23-04-035 outlines a path for eliminating gas incentives, and windows are considered a “gas exempt” measure due to providing gas savings without incentivizing a gas appliance. The California (CA) Investor-Owned Utilities (IOUs) have been asked by the California Public Utilities Commission (CPUC) to prioritize gas-exempt measures, such as high efficiency windows, have existing energy efficiency (EE) programs that can utilize a measure package once it is developed.

DEER Residential Building Prototypes for energy modeling

ENERGY STAR Windows V7.0 specification for measure efficiency

Modeling all 16 climate zones

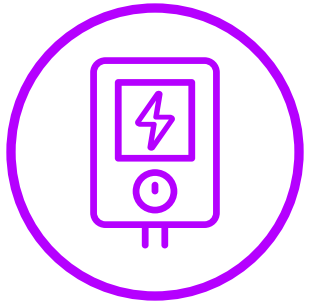
Single family, multi-family, and mobile home building prototypes

Opportunities

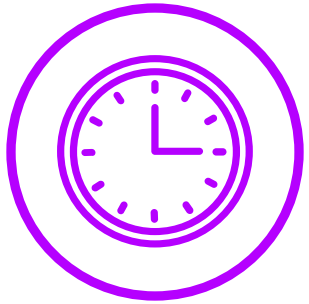
- Gas and electric savings potential
- Building envelope is an important aspect of electrification
- Existing residential programs that can utilize measure once it is developed
- There is no active deemed measure in CA for residential windows
- This project will create a residential windows measure for the CA eTRM

Project Timeline

- Main barrier: lack of deemed measure package



- Project is developing deemed measure package to the point of Cal TF submittal
- Energy Solutions will work with Lead PA (SCE) to work the measure package through CPUC approval after CalNEXT project scope is complete



- Project will eventually support codes and standards through increased adoption of high efficiency windows due to program intervention

Next Steps

- Currently running energy model simulations using DEER Residential Building Prototypes
- Compiling characterization of measure package
- Submitting measure package plan to Cal TF soon
- After the measure package is completed, all CA IOUs will have the opportunity to incorporate this program into residential programs they run

Thank you!

Kyle Booth, Energy Solutions

kbooth@energy-solution.com

CalNEXT

ET22SWE0031

Wastewater Treatment SB1383 Compliance Characterization

Fernando Miramontes, AESC

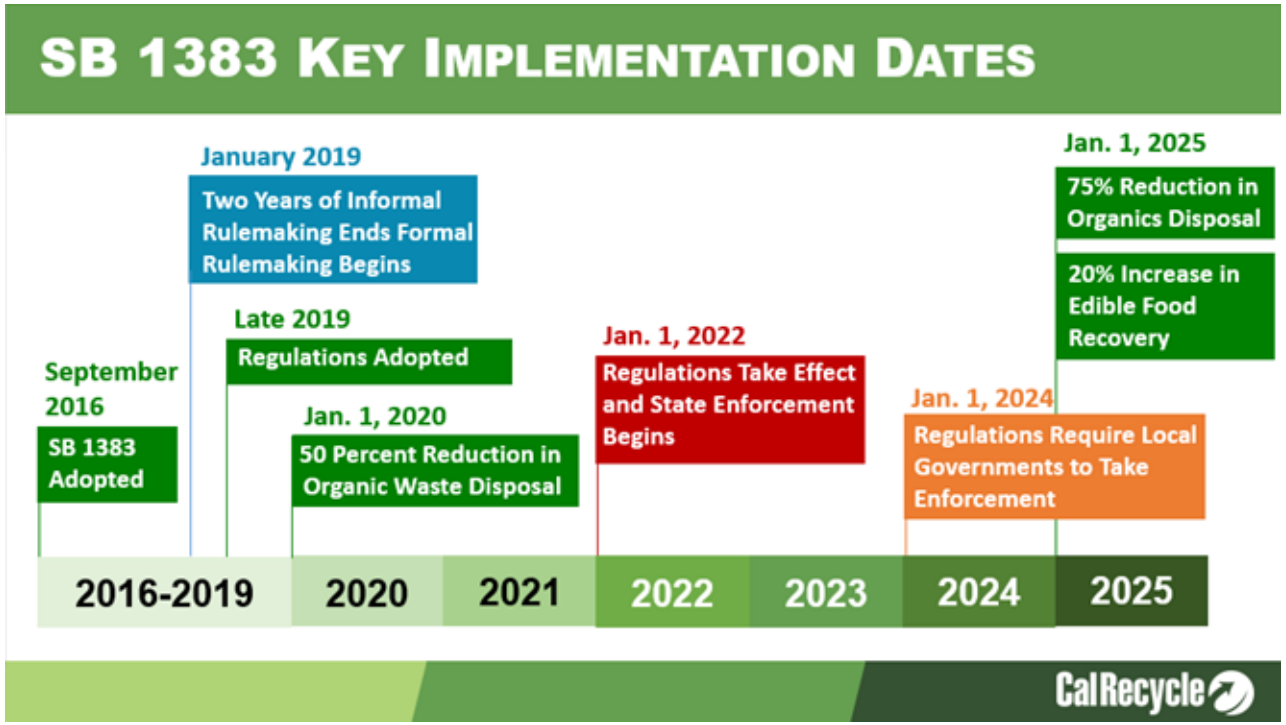
TPM Domain: Process Loads

Technology Family: Water Systems

Project Type: Program Support Research

Executive Summary

A market characterization of the various California Senate Bill No. 1383 (SB1383) Landfill Diversion compliance solutions under consideration or are in planning by wastewater treatment facilities. The State's vast network of operating facilities within the investor-owned utilities (IOU) territories offer significant untapped potential for process-based energy savings and load optimization related to both existing operations, planned expansions, and capital investments as a result of these legislative changes.



Opportunities

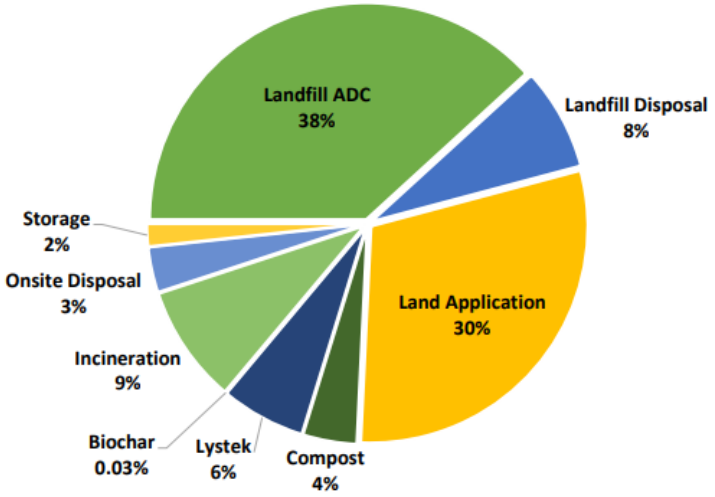
The handling of sludge and biosolids in the wastewater treatment process is a complex process that varies depending on the individual attributes and goals of the specific treatment facility. To further understand this, the study aimed to create a comprehensive account of the technology and treatment options available beginning at the source of the constituents, through the conveyance and processing, and final disposition of sludge and biosolids from WWTPs.

Handling or Processing Method	Function
Pumping	Transport of sludge and biosolids
Preliminary Operation	
Grinding	Particle size reduction
Screening	Removal of fibrous material
Degritting	Grit removal
Blending	Homogenization of sludge
Storage	Flow equalization
Thickening	
Gravity Thickening	Volume reduction
Flotation Thickening	
Centrifugation	
Gravity Belt Thickening	
Rotary Drum Thickening	
Stabilization	
Alkaline Stabilization	Stabilization
Anaerobic Digestion	Stabilization, mass reduction, resource recovery
Aerobic Digestion	Stabilization, mass reduction
Composting	Stabilization, product recovery
Heat Drying	Stabilization, mass reduction, resource recovery
Conditioning	Improve dewatering
Dewatering	
Centrifuge	Volume reduction
Belt Filter Press	
Rotary Press	
Screw Press	
Filter Press	
Drying Beds	
Advanced Dewatering	Volume reduction and stabilization
Reed Beds	Storage and volume reduction
Lagoons	
Conveyance and Storage	Transport and storage of sludge and biosolids

Project Timeline

Throughout the State, it is estimated that approximately 3,500 GWh of energy is used by the wastewater sector annually (approximately two percent of the total State's energy consumption), with an estimated existing burden of 525 GWh to solids handling. The optimization of these systems or displacement of traditional stabilization technologies has the potential to reduce this consumption significantly.

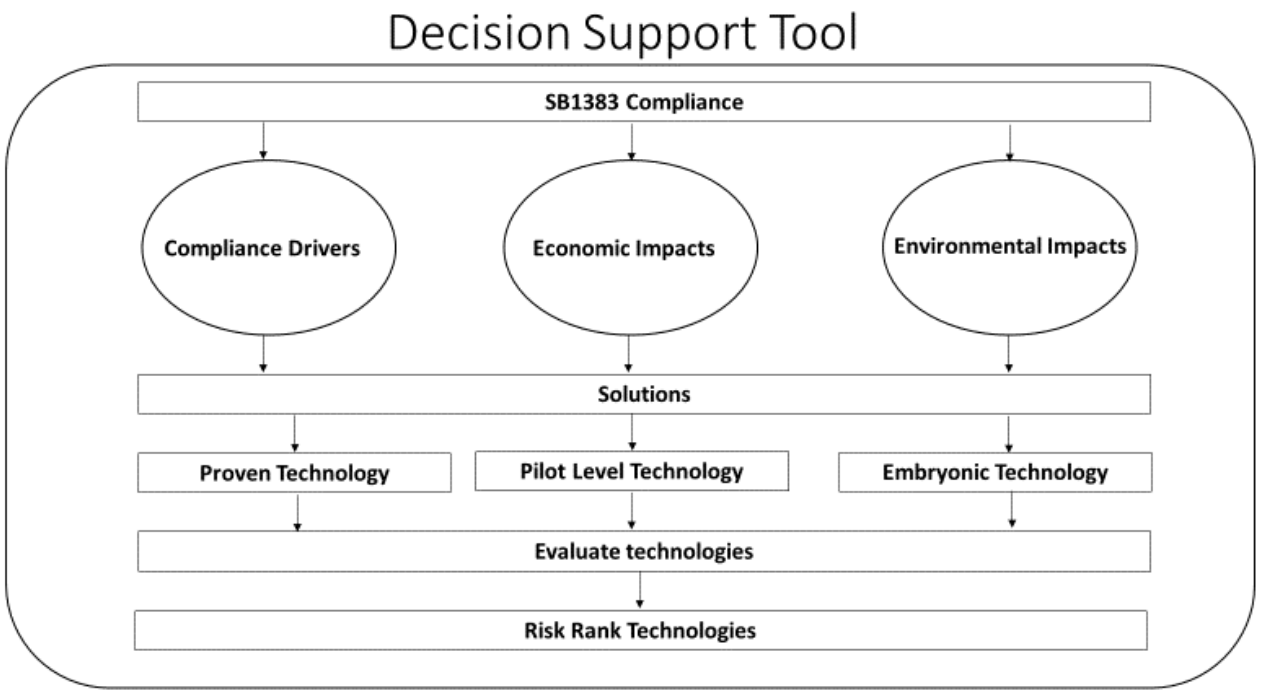
Process	Energy Consumption (GWh/yr)	Optimization Potential (GWh/yr)	Displacement Potential (GWh/yr)
Conveyance	2.3	0.3	-
Conditioning	2.7	0.4	-
Stabilization	490.3	73.5	441.2
Dewatering	14.9	2.2	13.4



For final reuse and disposal, most of the dry solids developed are distributed as landfill ADC (38%) and land application (30 percent). Conversely, the trends since 2015 demonstrate a reduction in sites disposing as landfill ADC, with an increase in land application and district approaches. The trend in reduction of landfilled biosolids and increase in beneficial reuse applications is expected to continue as a result of SB1383 requirements.

Next Steps

- It is recommended that agencies consider the development of a long-term plan for biosolids treatment and disposal, which addresses current and future regulatory requirements and markets.
- Agencies should investigate the development of an energy management plan to provide real-time visualization of unit process energy use, demand charges, brownout conditions, and anything that impacts energy use and manage energy use in a similar manner to process control.
- Agencies should also consider the environmental and economic impacts of generating biogas as part of the sludge conditioning process, with some new technologies offering systems that do not generate GHGs and appear to comply with the SB1383 requirements.



Thank you!

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CalNEXT

ET22SWE0054

Focused Pilot

Walk-in Cooler & Freezer Refrigeration Program Foodservice

Rocco Sucato, CEM, Energy Solutions

Foodservice Equipment, Refrigeration (commercial)

Plug Loads and Appliances

New Measure Development

Emerging Tech – Focused Pilot

Executive Summary

- The High Efficiency Condensing Unit (HECU) and High Efficiency Evaporator Unit (HEEU) Focused Pilot (FP) Program seeks to overcome the key barriers to the adoption of HECU/HEEU in commercial foodservice. Key components:

- Market Characterization Study (MCS)
- Qualified Products List (QPL)
- Onsite Equipment Monitoring
- Energy Performance Simulation modeling
- Midstream Incentive Pilot
- Measure package development preparation.

The HECU/HEEU FP is intended to interact with commercial foodservice businesses, refrigeration technicians, refrigeration equipment manufacturers, and refrigeration equipment distributors.

Opportunities

Existing refrigeration equipment is typically selected by a cost and performance basis during new construction or at time of failure.

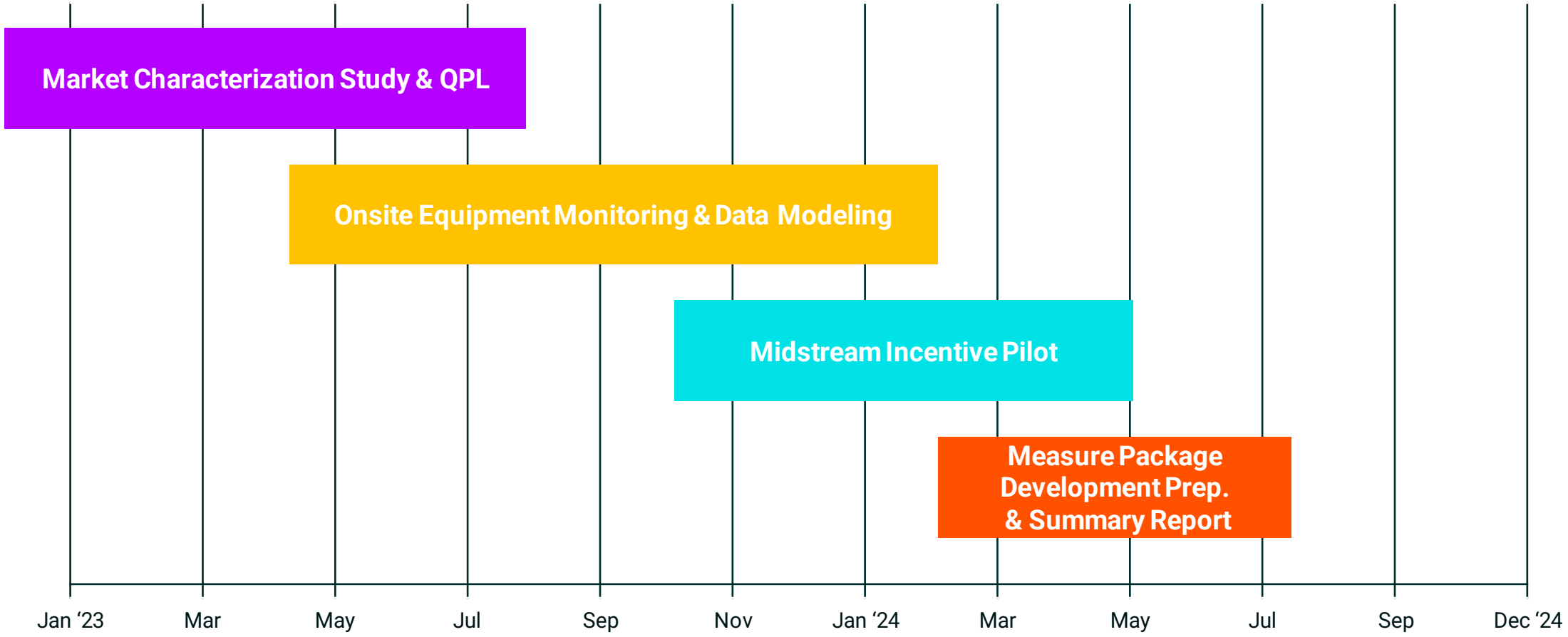
A lack of local inventory at the time of failure reduces the opportunity for FS businesses to upgrade to higher-efficiency equipment during an emergency scenario.

There is an opportunity to increase local inventory at the distributor level, add a whole unit incentive to the portfolio, lower entry costs, & increase awareness of HECU/HEEU benefits and inventory among contractors.

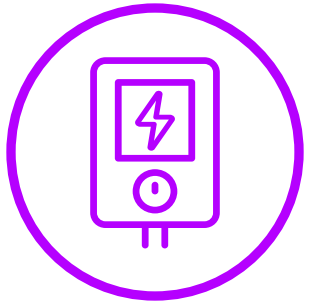
The Focused Pilot:

- Identifies barriers and potential interventions to increasing rate of market adoption
- Educates contractors about upselling EE opportunities
- Identifies existing manufacturers and models that are considered “high efficiency”
- Determines real-world savings expectations from site monitoring pilot
- Incentivizes distributors to modify stocking practices

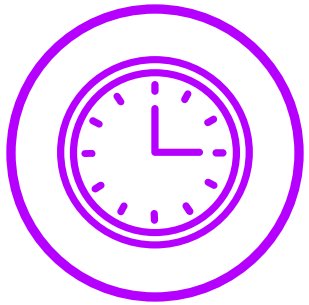
Project Timeline



- Main Barriers addressed:
  - **Lack of product availability** – Increase distributor HECU/HEEU stocking practices
  - **First Cost** – Test resource program designs purchasing habits
  - **Contractor Education and Advocacy** – Increase awareness of locally stocked HE options, pass on savings benefits to customers during decision making process



- Supports Statewide EE Portfolio by:
  - Reviewing walk-in refrigeration as a new measure for Foodservice
  - Providing EE equipment options at the model/unit level
  - Determining deemed energy savings for HECU/HEEU equipment



- Accelerates measure package development by:
  - Providing energy savings for future measure package development.
  - Testing resource program designs and impact on market prior to submitting measure package recommendation.

Next Steps

- Complete Site Monitoring Pilot data collection
- Model Energy Savings based on site monitoring data and 16 California climate zones
- Launch Midstream Incentive Pilot in partnership with select dealers and manufactures
- Contractor education webinar
- Draft Final Report

- Pending results of the site monitoring and midstream incentive pilots, the Final Report will be shared on the CalNEXT website, ETCC, and lay the groundwork for adopting a new walk-in cooler refrigeration measure in the EE portfolio.

- The Final Report will be used to suggest deemed energy savings in 16 climate zones, suggest incentive values based on equipment features and size, and identify eligible equipment models and features that clarify “what is high efficiency”

Thank you!

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CalNEXT

ET22SWE0057

Market Study of Household Electric Infrastructure Upgrade Alternatives for Electrification

Brian Picariello, Senior Consultant at VEIC

TPM Domain: Whole Buildings

Technology Family: Electrical Infrastructure

Project Type: Program Support Research

Executive Summary

This project is a **market assessment of commercially available intelligent power management technologies (IPMTs)**

- **Market scan** of the IPMT landscape and **vendor interviews**
- **Stakeholder engagement**: investor-owned utility (IOU) program managers and program implementers, direct install contractors, and staff at community-based organizations (CBOs).
- **Intended audience:** Customers, direct install contractors, California IOU energy efficiency and beneficial electrification program managers, and the California Emerging Technologies Coordinating Council.

Background

The Problem

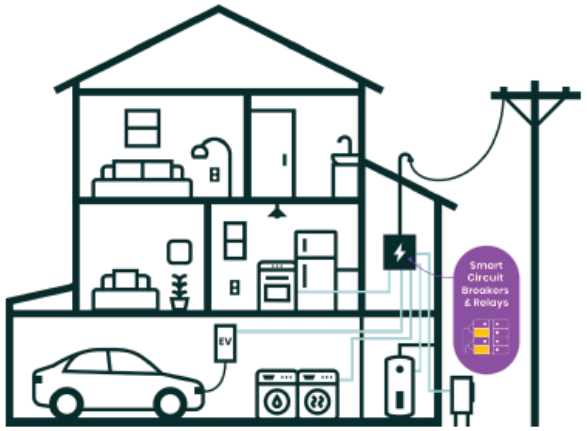
Estimated costs to increase electrical capacity in residential homes varies, but a recent analysis by NV5 Inc. and Redwood Energy estimate that cost may range "**between approximately $2,000 to well over $30,000**" and may require a "**lead time up to 6 months**" if utility work is required.

Potential Solutions

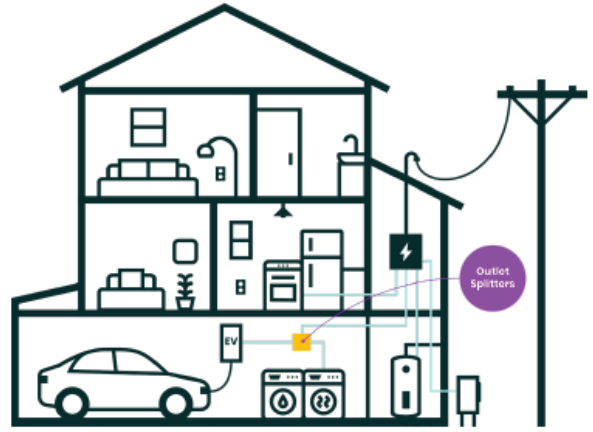
Emerging intelligent power management technologies ("IPMTs") may avoid the need for costly and time-consuming infrastructure upgrades by optimizing electrified load.

Smart Electrical Panels

Circuit Control Units

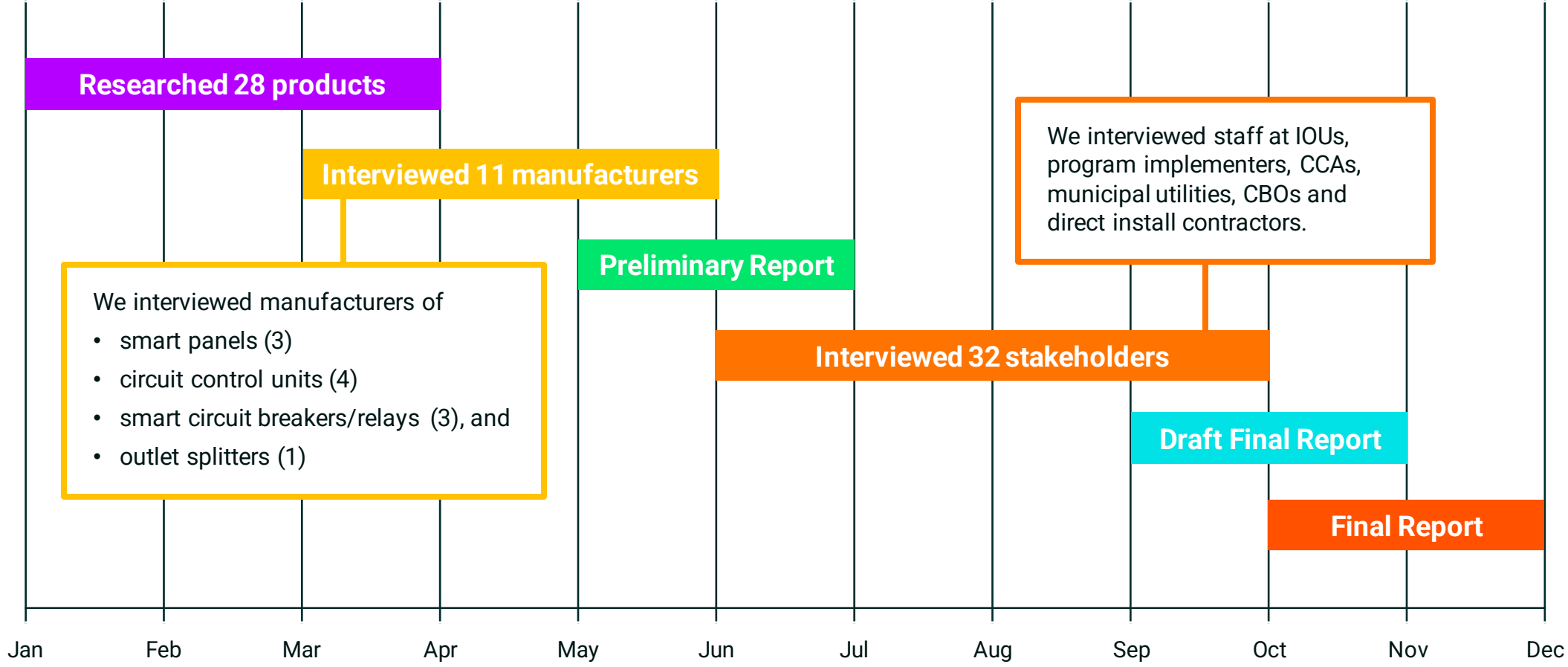


Smart Breakers and Relays



Outlet Splitters

Project Timeline



Preliminary Outcomes

What we found

- Not all products can do basic circuit load management
- Stakeholders were generally aware of benefits, but product awareness varied widely
- Barriers include lack of familiarity and install experience, confidence in product/manufacturer support, permitting & inspection uncertainty, and cost

What we recommend

- Increase awareness through educational materials and training for consumers, contractors, electricians and code officials
- Lab/field demonstrations may be conducted to evaluate basic functionality and inform education and training
- Provide incentives, especially for low-cost IPMTs, targeted towards retrofits

Next Steps

The **Final Report** will be published by the end of 2023.

VEIC will leverage marketing channels to share project findings and facilitate knowledge transfer.

Thank you to the VEIC project team, and our partner, The Ortiz Group.

Brian Picariello
Senior Consultant, VEIC
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CalNEXT

Poll 2

Q&A

AGENDA

10 AM – 10:43 AM PT
Intro to CalNEXT
Intro to HVAC and Water Heating TPMs
HVAC and Water Heating Projects
Q&A

10:45 AM - 11:24 AM PT
Intro to Whole Building and Process Loads TPMs
Whole Buildings and Process Loads Projects
Q&A

11:25 AM -12:00 PM PT
Intro to Plug Loads and Appliances and Lighting TPMs
Plug Loads and Appliances and Lighting Projects
Q&A

2022 Plug Loads & Appliances TPM

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
- Decarbonizing Household Appliances
- Household Appliances
- Light-Duty Battery Chargers
- Plug Load Optimization & Management Technologies
- Home Entertainment, Networking, Office, & Security Equipment
- Medical Equipment (Residential & Assisted Living)

2022 Lighting TPM

While lighting has been a primary focus in utility portfolios for years, it has had a diminished emphasis as savings opportunities from solid state lighting technology have been largely realized by programs, standards, and codes. However, modern lighting control systems have become granular, affordable, and data-rich sources of information about building conditions. There remains the potential to integrate with other building systems creating an opportunity for energy savings and demand flexibility in other building systems.

Tech Families of this group include:

- Connectivity, Controls, & Integration
- Horticultural Lighting
- DC Lighting
- Advanced Electric Light Sources
- Signage

Plug Loads and Appliances and Lighting

- **ET22SWE0027 -** Greenhouse Lighting Controls
  - Zyg Kunczynski, Energy Solutions

- **ET22SWE0022 -** Residential Housing Characteristics Study
  - Irina Krishpinovich, The Ortiz Group

- **ET23SWE0044 -** Benchtop Efficiency Measurements for Residential mesh Networking Equipment
  - Manuel Alexander Lopez, UC Davis

- Q&A

ET22SWE0027

Greenhouse Lighting Controls

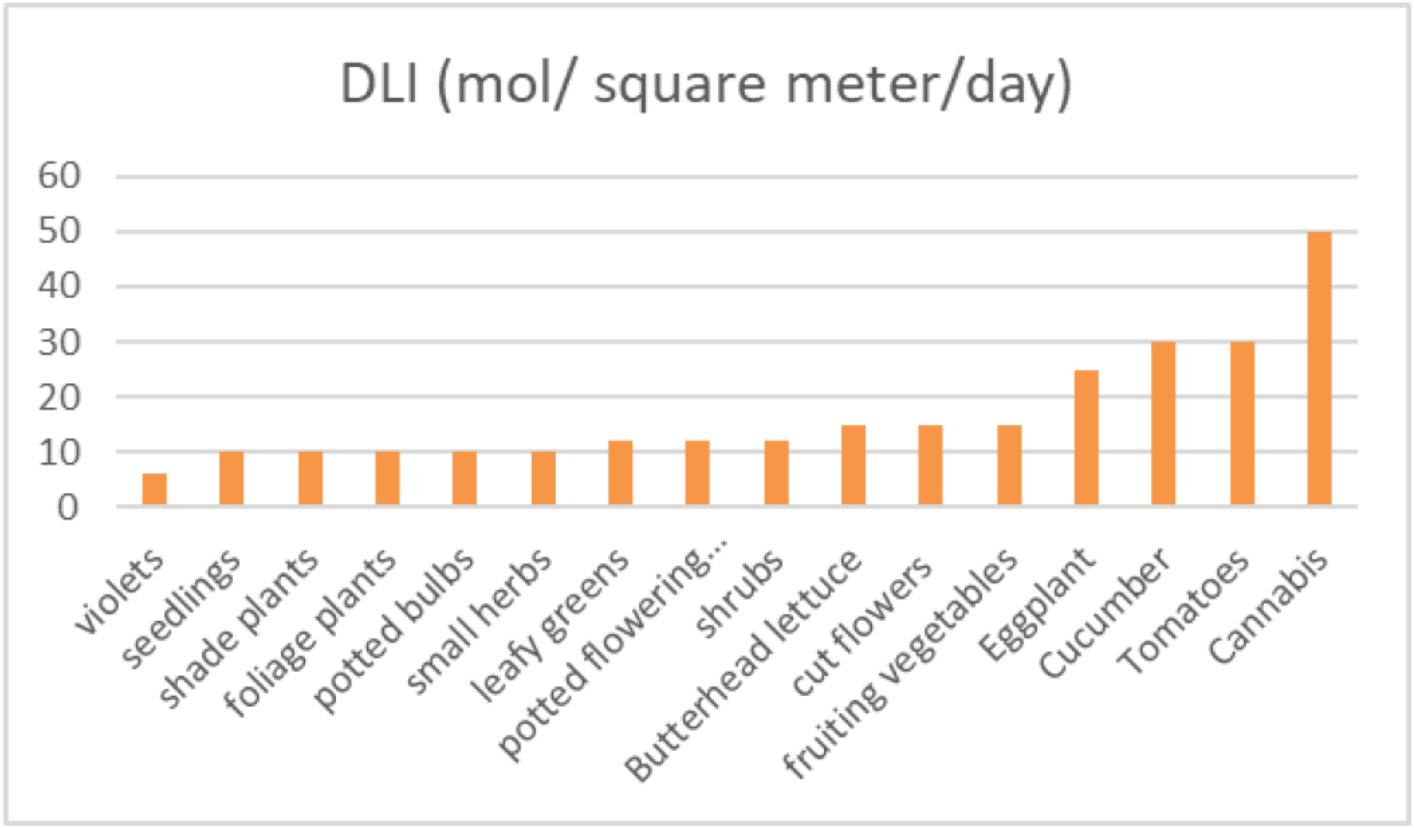
Zyg Kunczynski, Energy Solutions

TPM Domain	Lighting
Technology Family	Integrated Controls
Program Development Support	New Custom Measure Development
Tactic	Field Evaluation

Executive Summary

1. Legal cannabis projected to consume over 380 gigawatt-hours by 2022.
2. Adaptive Lighting Controls can save energy by dimming lights if there is surplus light.
3. Assumed baseline: on/off timer with no dimming.
4. Savings very dependent on user behavior.
5. Could NMEC be a way to accelerate adoption?
    - NMEC projects must save 10% annual consumption to be approved.
    - Modeled savings for lighting controls- Cannabis: 9% and Tomatoes: 11%
    - Test project would have to include other measures like HVAC, dehumidification and transmittance. It is standard practice to modify other systems when lighting is modified.

Opportunities

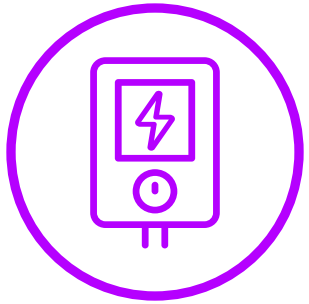


Legal cannabis projected to consume over 380 gigawatt-hours by 2022.

Project Timeline

Barriers and solutions

- Savings cannot be predicted because they depend on user behavior
- User behavior cannot be predicted because most farmers do not have lighting targets
- Lighting changes lead to changes in other factors like HVAC



How this project supports the Statewide EE Portfolio

- NMEC projects create measurable savings but are difficult to get approved
- Indoor Agriculture could be a good application for NMEC

Next Steps

- Industry actor application approved
- Industry actor receives CalNEXT funding to create an NMEC project
- Use CalNEXT report to help recruit Test Site and M&V Partner

Greenhouse Lighting Controls

Final Report

ET22SWE0027

Thank You

Zyg Kunczynski

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CalNEXT

ET22SWE0022

Residential Housing Characteristics Study

Irina Krishpinovich, The Ortiz Group

Technology Support Research

TPM Domain: Whole Building Residential

Tech Family - Other: Housing characteristic data to inform future building electrification

Project Type: Market Study

Efficiency Program: Residential

Executive Summary

- **Characterize** existing DAC single family residence (SFR) building stock through publicly available census data relevant to electrification and electrification programs.
- **Develop and validate a field survey by gathering information from a sample** of 50 DAC / HTR residences.
- **Characterize existing DAC/HTR SFR building stock and electrification readiness** based on census and limited field survey analysis.
- **Develop recommendations** for future programs and interventions necessary for facilitating equitable electrification in DAC and HTR communities.

The intended audience for this study are stakeholders working on low-income, residential, electrification program or policy design.

Opportunities

- Water Heating Opportunities: Heat pump water heaters are a key strategy to building decarbonization by providing a cost-effective, all-electric water heating option, with significant electricity savings over resistance heating, with strong potential for demand flexibility depending on factors of household size and tank size.
- Higher adoption of HP WH and HVAC may warrant special considerations of equity to ensure reduced exposure to combustion gases is beneficial to all ratepayers.
- Plug Loads and Appliance Opportunities: Higher adoption can reduce energy consumption and increase efficiency. Specifically, induction cooking appliances and higher efficiency electric resistance clothes dryers and HP clothes dryers.

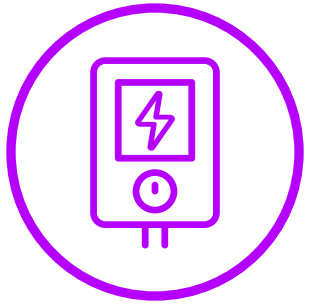
This market study aimed to establish a baseline of DAC/HTR housing characteristics in terms of electrification readiness.

- Vintage and condition of home
- Utility service capacity
- Electrical panel condition
- Location and type of HVAC & WH
- Type cooking appliance and clothes dryer

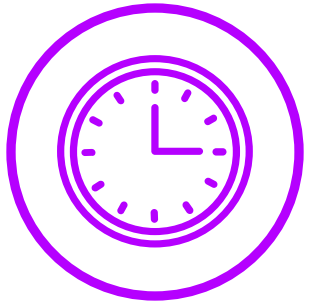
The baseline can be used to design and estimate costs for future equity electrification programs.

Project Timeline

- Barriers to electrification viewed through an equity lens focused on existing conditions:
  - Structure, electrical system (service and panel), gas appliances, plug loads
  - Feasibility of electrification and occupant readiness to adopt electrification
  - A meaningful sample size across all regions to support recommendations



- As a market study, this project has the potential to inform Statewide EE portfolio
  - Low Income electrification program / pilot design
  - Accelerating / increasing electric HP measures into existing Low-Income direct install programs
  - Standardizing electrification opportunity assessment and the messaging required for adoption



Final Report

The Final Report findings may inform future CalNEXT projects

- The project approach to data collection could help other initiatives
- Results of census analysis included in the report provides a view into socio-economic conditions of DAC/HTR as it relates to electrification readiness.
- Current plans exist for a 400 statewide survey / study in 2024

The report can be downloaded:

- ETCC: https://lead.etcc-ca.com/reports/residential-housing-characteristics-study
- CalNEXT: https://calnext.com/approved-projects/

Next Steps

This project is completed

- Next steps are to build on the findings and expand the study to include Statewide results
  - 400 surveys vs. 50 completed
  - Expand the network of data collection (ESA Contractor, CBO, Energy Auditors)
- Findings may be of interest to parties designing or implementing zonal approaches to equity electrification
  - Census data analysis of DAC/HTR readiness and fit for electrification
    - ACS datapoints
    - NREL Building Stock datapoints
- Work with interested utility and community stakeholders on equity electrification initiatives
  - The study describes barriers, socio-economic and structural (DAC/HTR), that should be considered to develop strategies on how to increase adoption of electrification

Thank you

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CalNEXT

ET23SWE0044

Benchtop Efficiency Measurement for Residential Mesh Networking Equipment

Manuel Lopez, California Lighting Technology Center

Plug Loads & Appliances

Home Entertainment & Office Equipment

Technology/Program Support

Lab Evaluation

UCDAVIS
California Lighting
Technology Center

Executive Summary

The Benchtop Efficiency Measurement for Residential Mesh Networking Equipment project is aimed to fully characterize the energy efficiency and performance of mesh network products that are commercially available compared to traditional approaches.

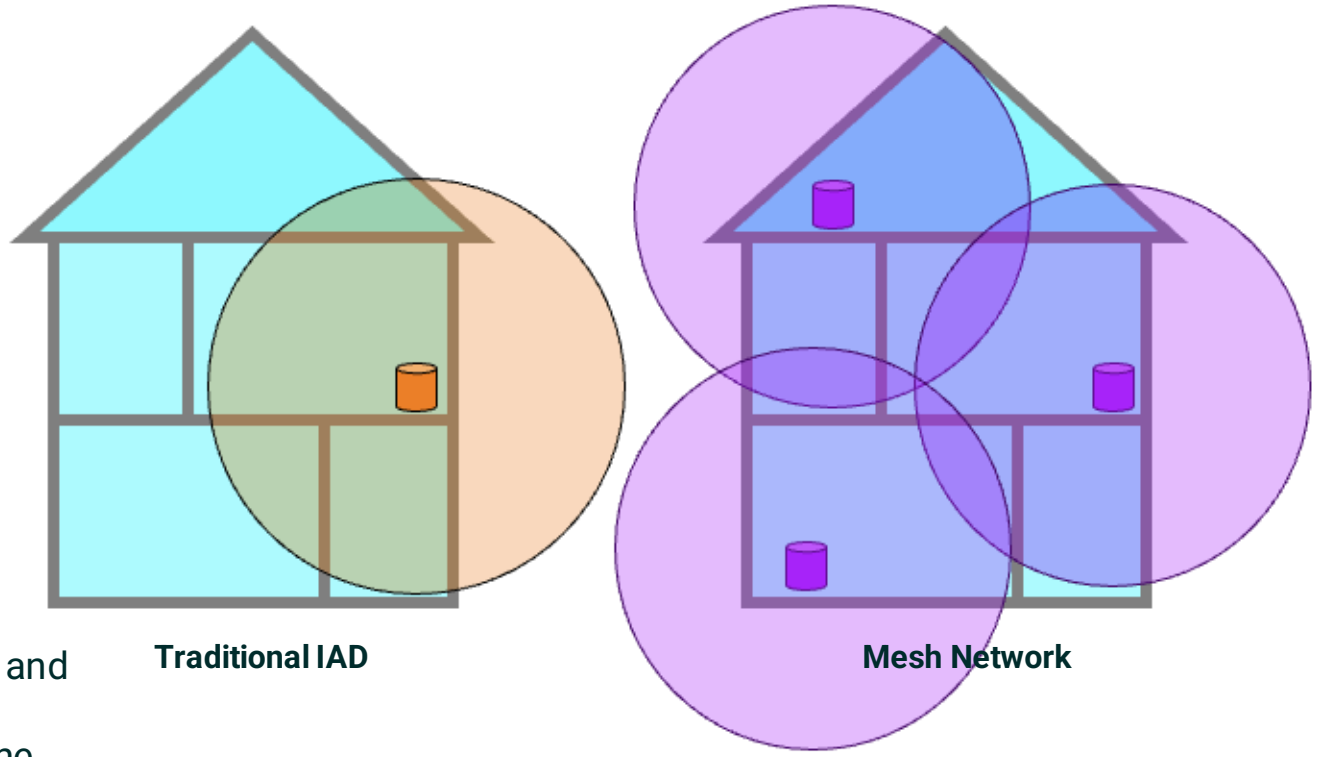
What is a Mesh Networking Systems (MNS) and what are the benefits?

- Expanded Coverage
- Easy Scalability and Customization
- Seamless and Improved Roaming

The project team aims to answer:

- Characterize the performance of commercially available MNS
- Identify the impact of MNS adoption in homes and statewide
- Provide code and standard recommendations

Team plans to achieve goals through a multi-step sequential approach starting with a market study to identify products and trends. Developing and executing a test methodology, leveraging existing industry accepted standards (ANSI/CTA-2049a, IEC 62301), that would fully characterize the performance differences between MNS and traditional IADs. Then lastly applying findings to characterize overall impact of continued adoption, generate recommendation for product and standard transformation, and propose methods for engaging the industry.



Traditional IAD **Mesh Network**

Opportunities

Initial look at IAD market:

- 9 of the top 10 RNE manufacturers have developed mesh networking devices
- Mesh networking devices account for ~40% of IAD products for sale
- Average lifespan of RNE is 2-3 years

Annual energy consumption of IADs within the U.S. is estimated to be 11.9 TWh based on a 2020 study focused on power consumption of consumer electronics. With market directing consumers towards mesh networks, energy consumption could easily double in 5 years based on initial estimates for mesh networks power consumption.

The RNE market is mainly regulated by voluntary agreements. These programs at this time do not take into account the cumulative energy impacts of each individual mesh device, combined with typical selling practices of packaging three networking nodes.

ProjectTimeline

Project team has begun initial research for Preliminary Findings Report

Statewide EE Portfolio

- Project is under the Plug Load & Appliance Home Entertainment & Office Subcategory within the 2023 TPMs.
- The evaluation aims to address the identified barriers and opportunities associated with the rapidly evolving market.

Project Barriers

- Quick-paced industry with consistent innovations
- Short lifespan of targeted products

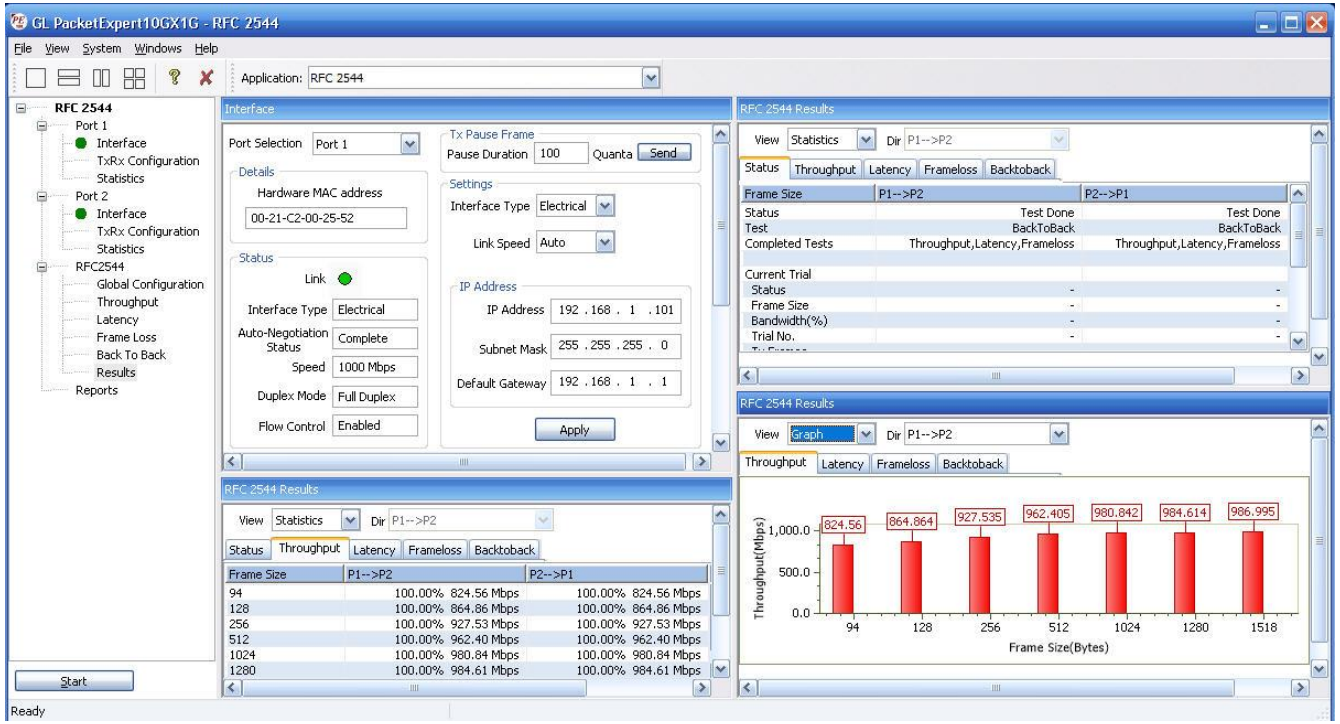
Codes and Standards

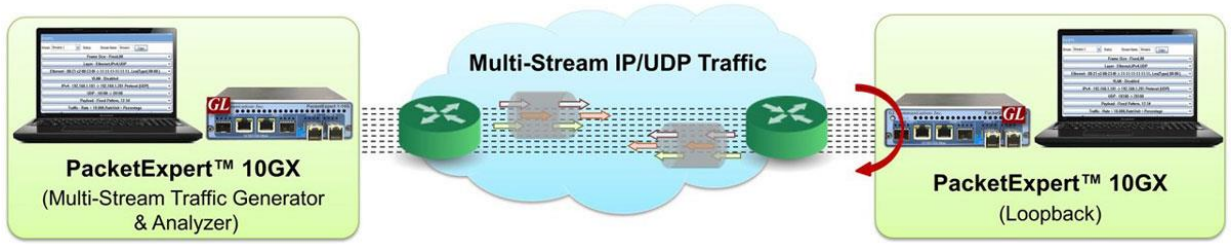
- Sunsetted EnergyStar Small Networking Equipment Specification
- Voluntary Agreement for Ongoing Improvement to the Energy Efficiency of Small Network Equipment.

Next Steps

Next steps for this project would be completion of Preliminary Findings Report:

- Market Study
- Test Methodology Development
- Select Products





Thank you

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CalNEXT

Poll 3

Q&A