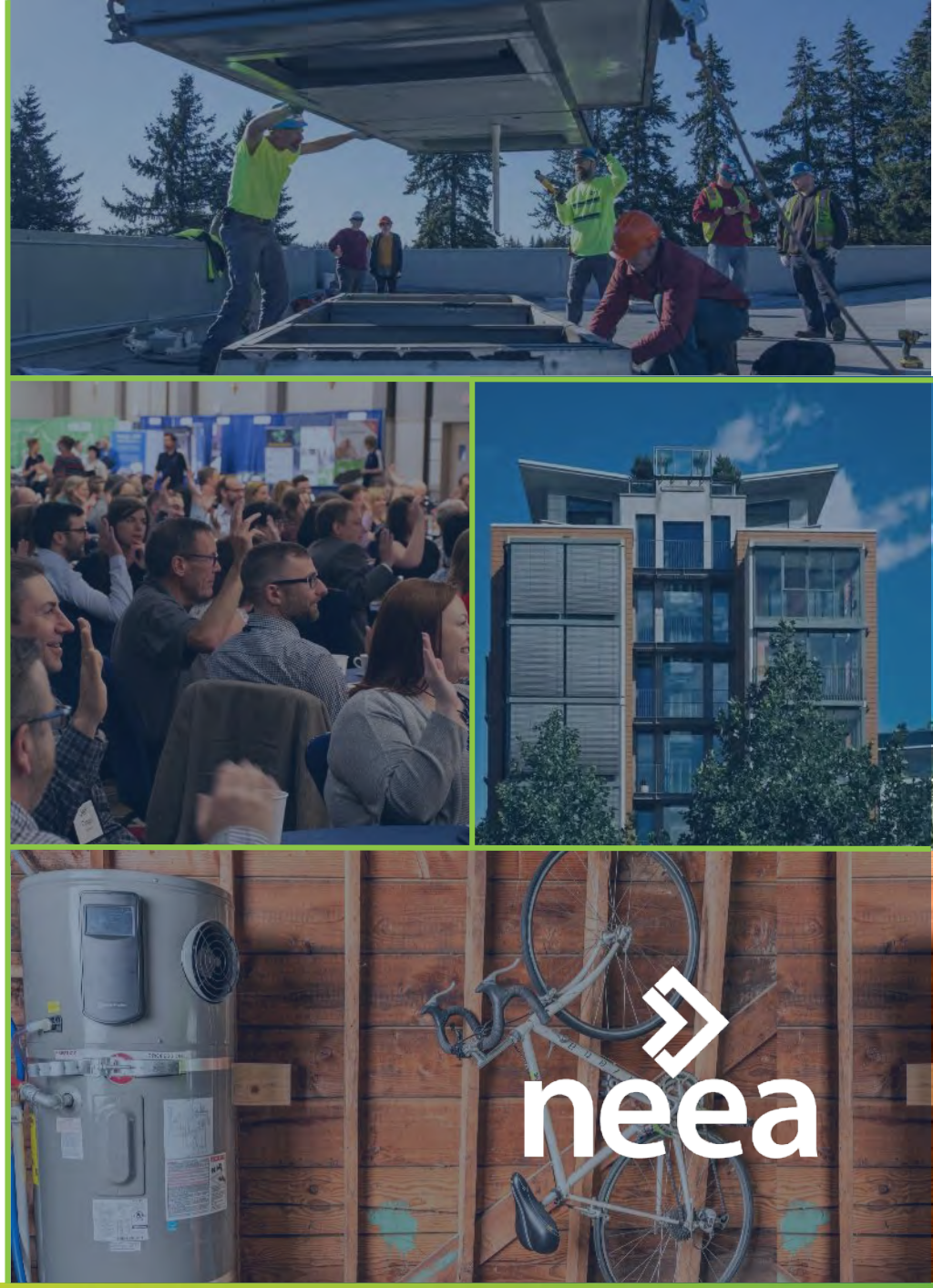
Regional Emerging Technology Advisory Committee (RETAC)

Northwest Energy Efficiency Alliance

Q2 2023 Meeting

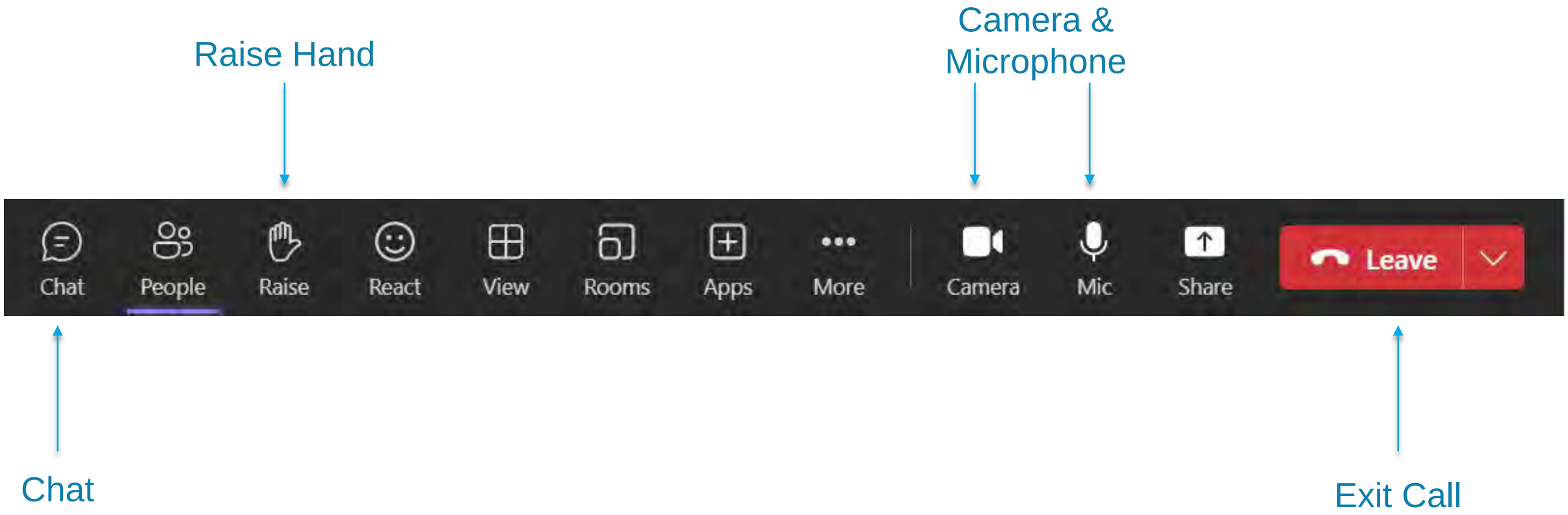
June 27, 2023

9:00am – 3:15pm



CLASSIFICATION LEVEL: PUBLIC

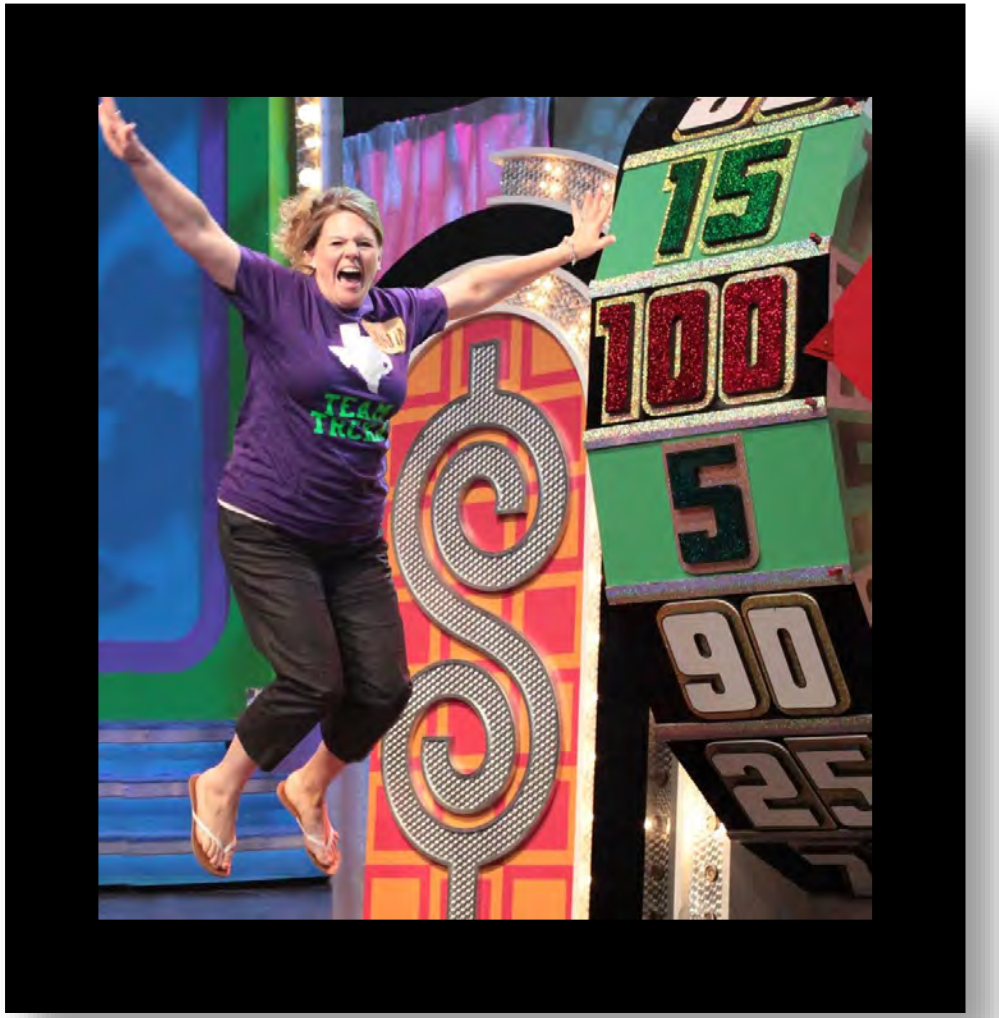
Navigating MS Teams Layout



Note: These options may vary, depending on which version you're using.

Name,
Title,
Organization
and …

If you could be on any game show, which would you choose?



Agenda

9:00 am	Welcome, Agenda Review, Announcements, Conferences & Product Council Updates
9:45 am	*New!* California IOU Emerging Technology Update
11:15 am	*Break (15 min)*
11:30 am	*New!* Snohomish PUD Emerging Technology Update
12:00 pm	*Lunch (60 min)*
1:00 pm	*New!* 2023 Scanning Projects
2:00 pm	*New!* Dual-Fuel Technology
3:00 pm	Public Comment, Poll & Adjourn

Announcements

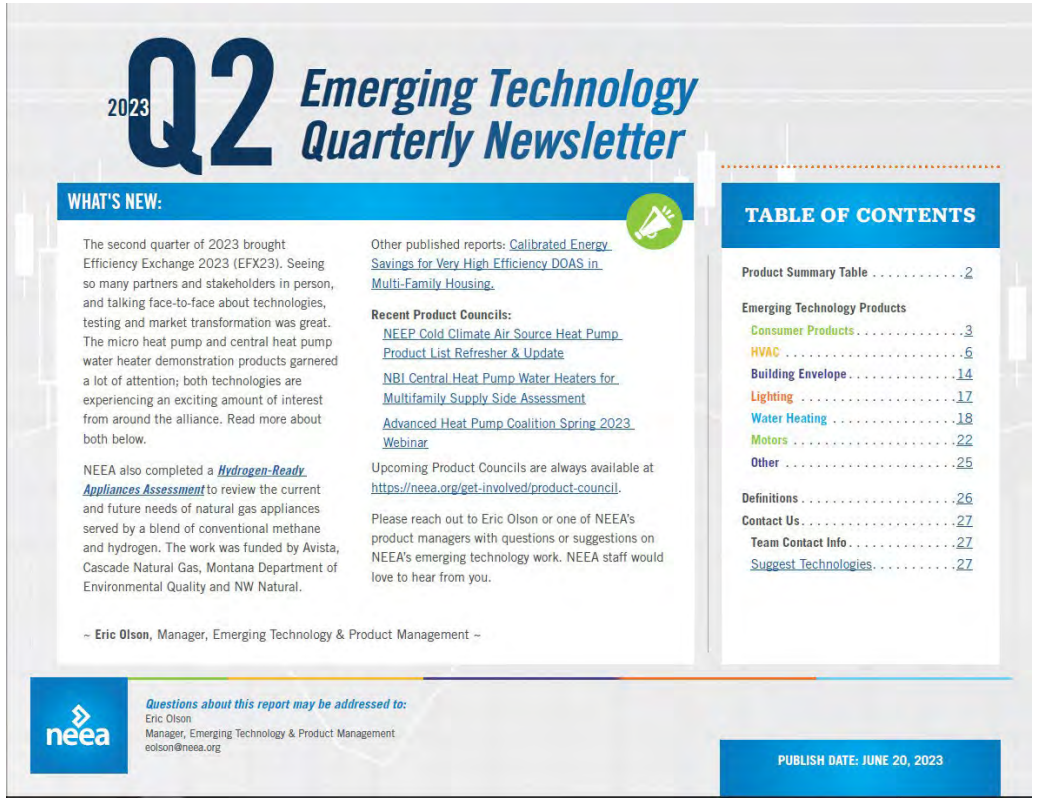
Efficiency Exchange Conference

Save the Date: May 14-15, 2024

Coeur d'Alene, Idaho

neea.org/EFX

Q2 2023 Emerging Tech Newsletter



2023 Q2 Emerging Technology Quarterly Newsletter

WHAT'S NEW:

The second quarter of 2023 brought Efficiency Exchange 2023 (EFX23). Seeing so many partners and stakeholders in person, and talking face-to-face about technologies, testing and market transformation was great. The micro heat pump and central heat pump water heater demonstration products garnered a lot of attention; both technologies are experiencing an exciting amount of interest from around the alliance. Read more about both below.

NEEA also completed a *Hydrogen-Ready Appliances Assessment* to review the current and future needs of natural gas appliances served by a blend of conventional methane and hydrogen. The work was funded by Avista, Cascade Natural Gas, Montana Department of Environmental Quality and NW Natural.

Other published reports: Calibrated Energy Savings for Very High Efficiency DOAS in Multi-Family Housing.

Recent Product Councils:

NEEP Cold Climate Air Source Heat Pump Product List Refresher & Update

NBI Central Heat Pump Water Heaters for Multifamily Supply Side Assessment

Advanced Heat Pump Coalition Spring 2023 Webinar

Upcoming Product Councils are always available at https://neea.org/get-involved/product-council.

Please reach out to Eric Olson or one of NEEA's product managers with questions or suggestions on NEEA's emerging technology work. NEEA staff would love to hear from you.

~ **Eric Olson**, Manager, Emerging Technology & Product Management ~

TABLE OF CONTENTS

neea

Questions about this report may be addressed to:
Eric Olson
Manager, Emerging Technology & Product Management
eolson@neea.org

PUBLISH DATE: JUNE 20, 2023

- Now including recent Product Councils on the “What’s New” section
- Selected Q2 Highlights
  - Hydrogen-Ready Appliance Assessment published
  - Multi-Family field study using very high efficiency DOAS principals was published
  - U.S. DOE adopted ANSI/CTA-2037D as TV Test procedure

https://neea.org/resources-reports

2023 RETAC Meeting Dates

Q1	Thursday, March 30
Q2	Tuesday, June 27
Q3	Thursday, September 21
Q4	Thursday, December 14

Conferences

Product Councils

Conferences

Past Conferences

- Better Buildings, Better Plants Summit – April 2023
- Building Technology Office Peer Review – April 2023
- Utility Energy Forum – April 2023
- IEEE Sustainable Technologies Conference – April 2023
- Efficiency Exchange – May 2023
- Getting to Zero Forum – May 2023
- IEA Heat Pump Conference – May 2023
- LightFair 2023 – May 2023
- CEE Summer Session – June 2023

Upcoming Conferences

- Building Owners and Managers Association Convention – June 2023
- CEE Integrated Homes Challenge – June 2023
- Window & Door Manufacturers Association – June 2023
- ACEEE 2023 Industrial Summer Study – July 2023
- Illuminating Engineering Society Conference – August 2023
- Smart Building Exchange – August 2023

Q2 2023 Product Council Presentations

Presenter	Topic	Date Scheduled	Webinar Recording
Christopher Dymond	Advanced Heat Pump Coalition Spring 2023 Webinar	5/10/23	Northwest Energy Efficiency Alliance (NEEA) | Advanced Heat Pump…
Ranal Tudawe, MN CEE	Displacing Central Air Conditioners with Air-Source Heat Pumps for a Dual-Fuel Energy & Cost Savings	6/20/23	Northwest Energy Efficiency Alliance (NEEA) | Displacing CAC with…

Upcoming Product Council Presentations

Presenter	Topic	Date Scheduled	Registration Link
Christopher Dymond	Micro Heat Pump Field Study	7/18/23	Registration Link
Christopher Dymond	VSHP Advanced Features & Capabilities Update	8/1/23	Registration Link
Christopher Dymond	Rating Representativeness Preliminary Results	8/15/23	Registration Link

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California IOU Emerging Technology Update

CalNEXT at NEEA's RETAC

June 27, 2023

CalNEXT ENERGIZING CALIFORNIA'S FUTURE

Tim Minezaki
Energy Solutions

Agenda

1	Introduction	10 min
2	Overview of CA ET Landscape & Key Policy Drivers	10 min
3	CalNEXT Program Nuts & Bolts	25 min
4	CalNEXT Projects Overview	15 min
5	Ways to partner: CalNEXT & RETAC	10 min
6	Open Question Time	20 min

About Me

- **Title:** Senior Staff Engineer at Energy Solutions
- **Pronouns:** He/Him
- **Location:** SF Bay Area, California
- **Role:** Lead Technical Strategy for CalNEXT
- **Previous Roles:** 14+ year history on EE programs.

  - Engineer supporting audits & custom EE programs in C&I

  - Managed Emerging Tech demonstration projects

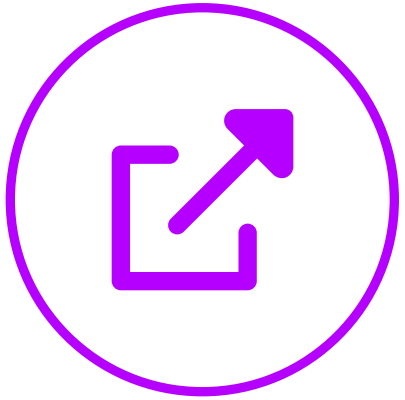
  - Codes and standards supporting the CA IOUs

What is CalNEXT

CalNEXT is funded by the California IOU's Statewide **Electric** Emerging Technologies Program. Our program is designed to serve the IOUs with new research to expand the IOU portfolio. Contrary to typical ET programs, CalNEXT's focus is on later-stage market development and deployment.

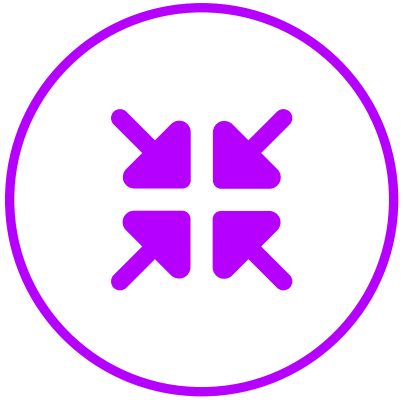
Energy Solutions will be the prime administrator for the next five years. Our overall program budget is approximately $17 million per year.

CalNEXT Project Types



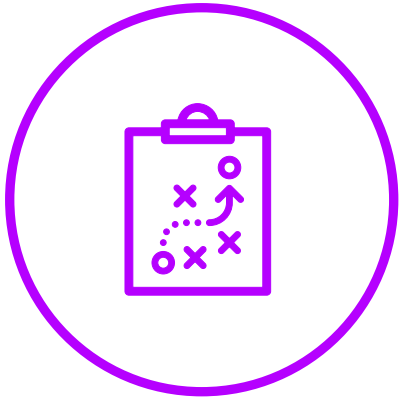
Technology Development Research

Projects focused on addressing market barriers or developing the commercial capability of *early-stage technologies*.



Technology Support Research

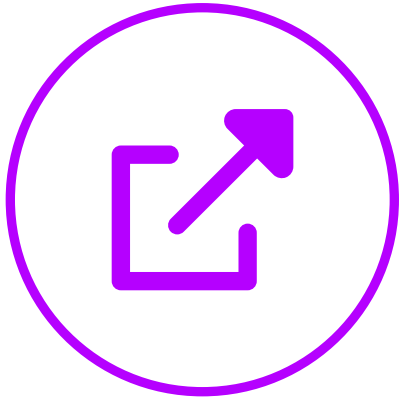
Focused on addressing market barriers or developing the commercial capability of *market-ready technologies*.



Focused Pilots

Projects focused on high-impact technologies and conduct pilot tests through installations and interventions

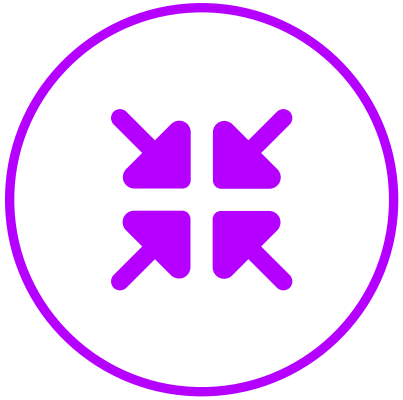
CalNEXT Project Types



Technology Development Research

Projects focused on addressing market barriers or developing the commercial capability of *early-stage technologies*.

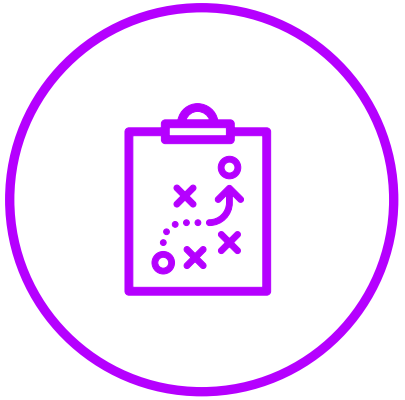
[18%, 8 projects per year]



Technology Support Research

Focused on addressing market barriers or developing the commercial capability of *market-ready technologies*.

[~75%, 32 projects per year]

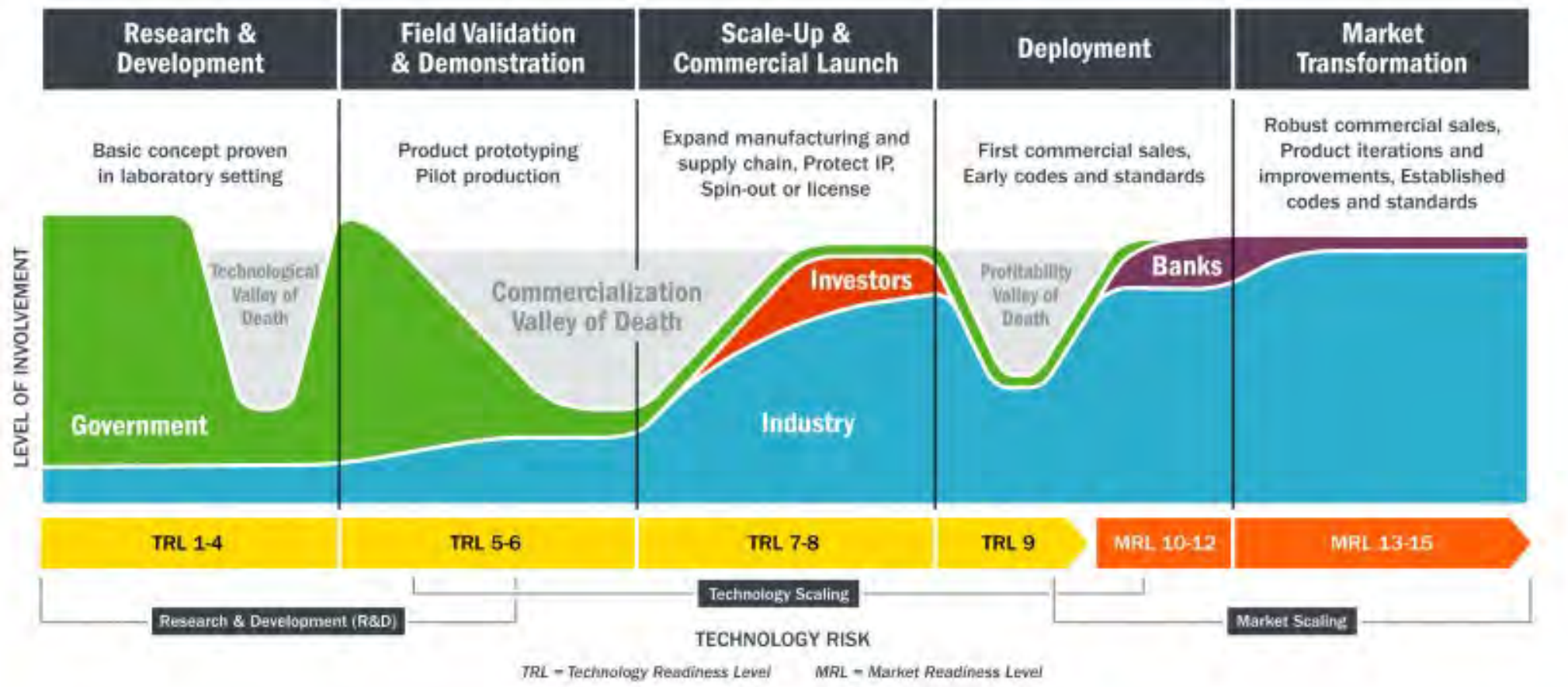


Focused Pilots

Projects focused on high-impact technologies and conduct pilot tests through installations and interventions

[~7%, 3 projects per year]

What TRL levels does CalNEXT work on?



CalNEXT
ENERGIZING CALIFORNIA'S FUTURE

CalNEXT

Partner Team

Energy Solutions

veic

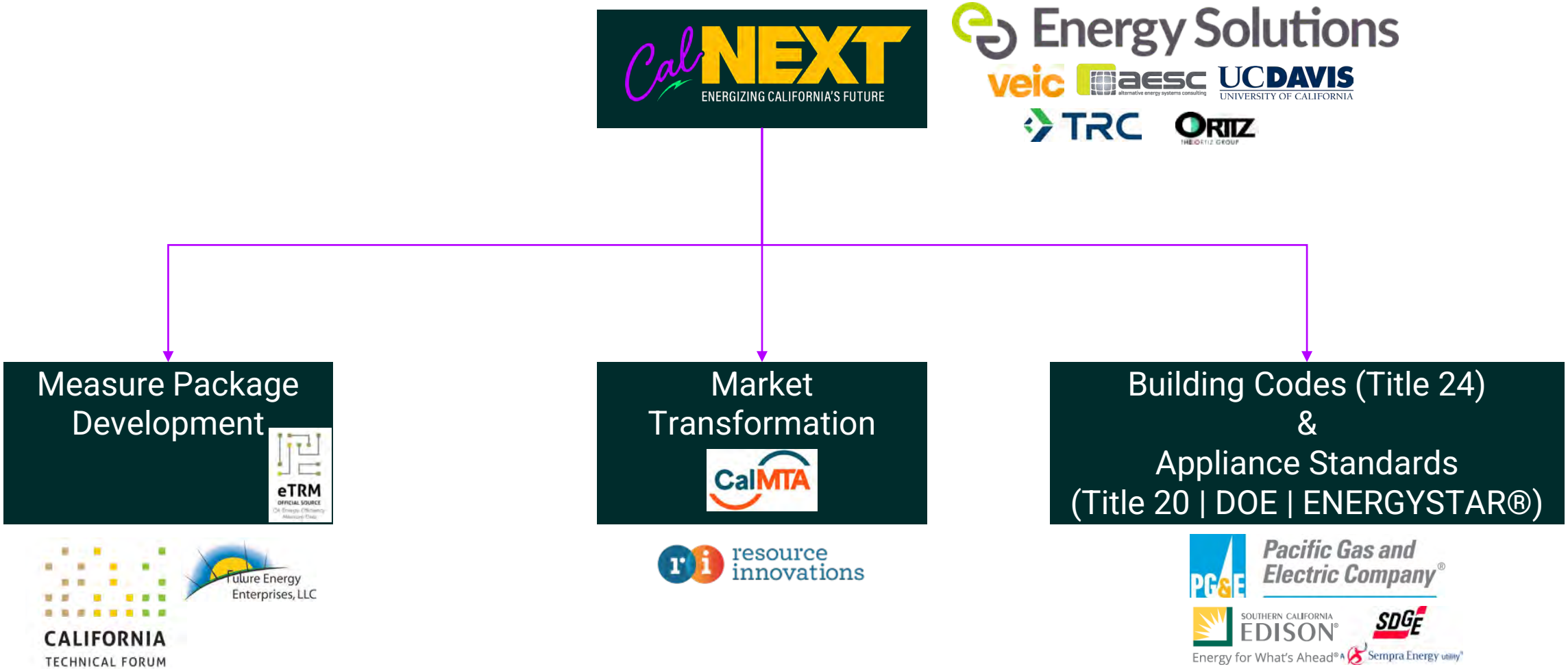
aesc
alternative energy systems consulting

ORTIZ
THE ORTIZ GROUP

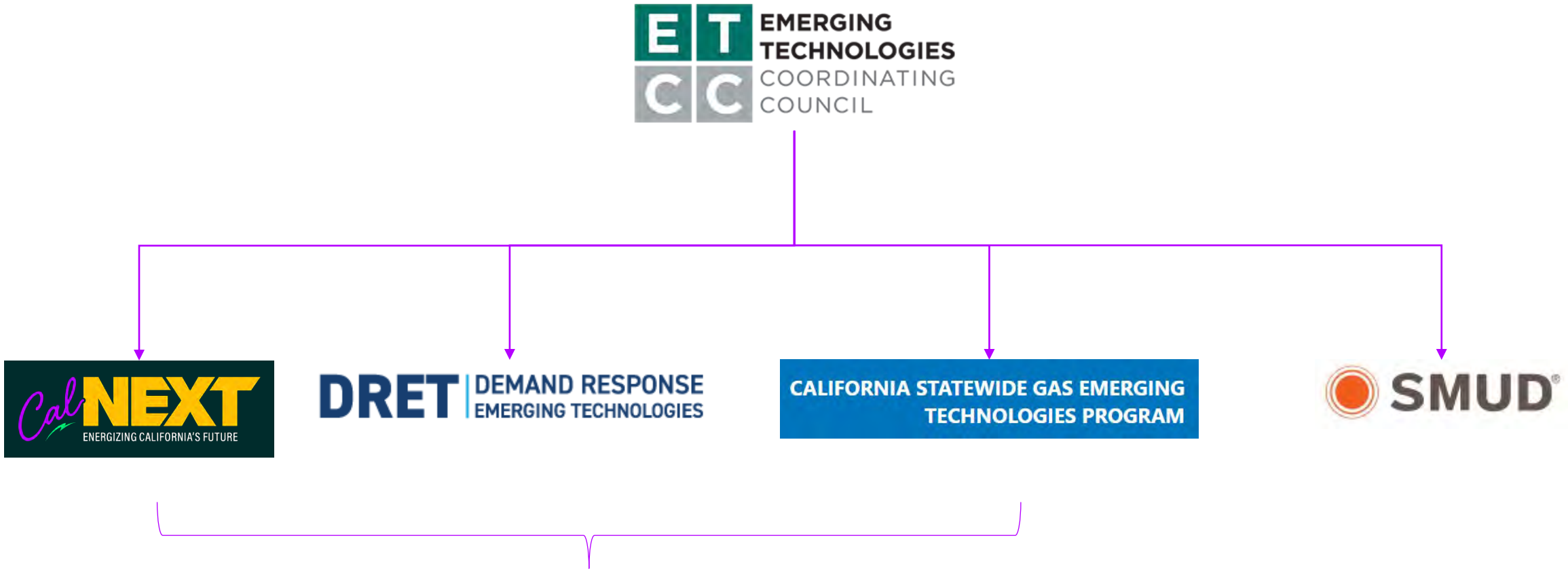
TRC

UC DAVIS
UNIVERSITY OF CALIFORNIA

Focus: Transferring to the IOU Portfolio



Other ET efforts in California



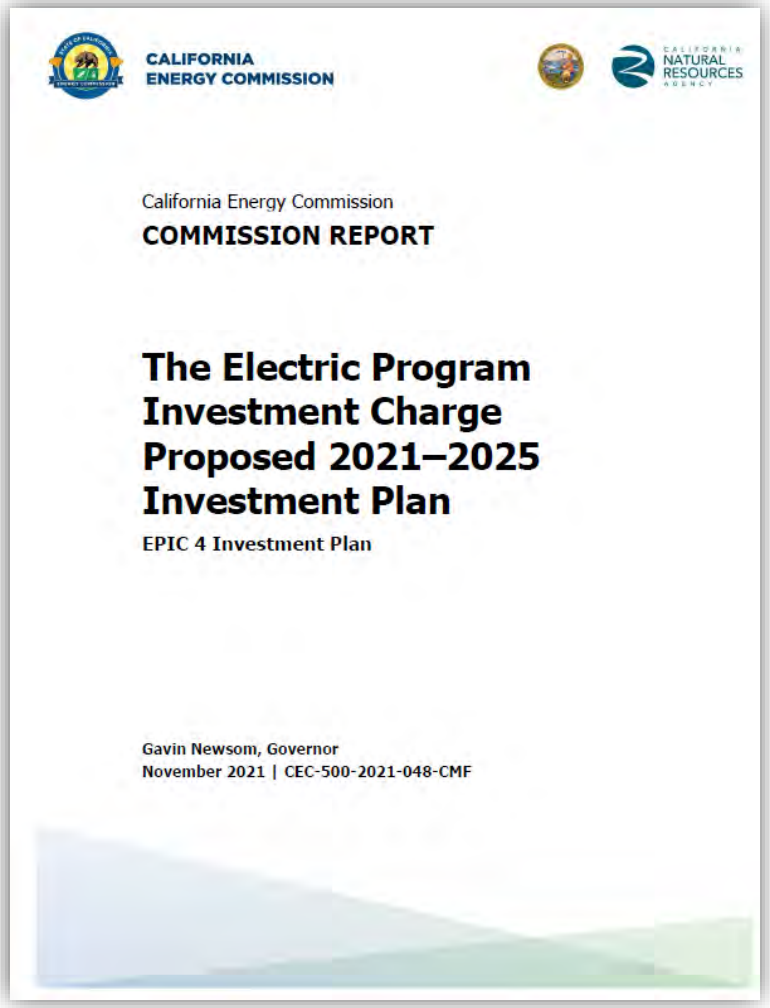
Investor–Owned Utility
Emerging Tech Programs

Non-utility research in California

CALIFORNIA ENERGY COMMISSION

Six Strategic Objectives

1. Accelerate Renewable Generation
2. Grid reliability & Renewable transition
3. Improve Value Proposition of DERs
4. Improve Value Proposition for End-Use Efficiency & Electrification
5. Enable Cleantech Entrepreneurship
6. Inform CA's Transition to Equitable Zero-Carbon System



Key Policy Drivers in California

1. CPUC's Total System Benefit (D 21-05-031)

2. Accelerate Heat Pump Deployment
   6 Million Heat Pumps by 2030 | 50% of investments to Low-Income

3. Gas Incentive Phase Out (D 23-04-035)
   Phase out of gas incentives if there is a "viable" electric alternative

4. Flexible Demand Appliance Standards (FDAS)
   SB-49: Develop standards to enable load shifting

5. Embodied Carbon, reducing GHG in building materials
   AB-2446: 20% reduction by 2030, 40% reduction by 2035
   **Requires life-cycle cost assessments

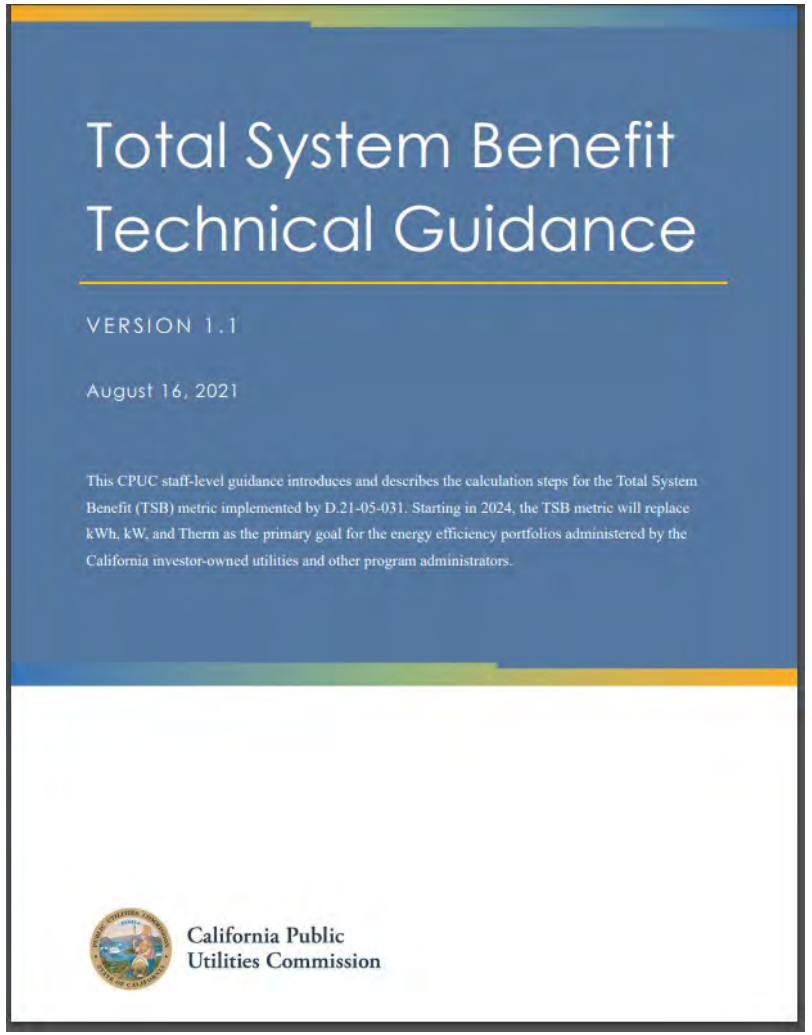
CPUC & Total System Benefit (TSB)

All programs are moving from kW / kWh / Therms to a new metric called Total System Benefit (TSB). TSB has three different components that have implications for what kinds of research to support next gen of programs:

(1) Avoided gas infrastructure
[Captures fuel substitution benefits]

(2) Avoided refrigerant emissions
[Penalizes high-charge & high-gwp systems]

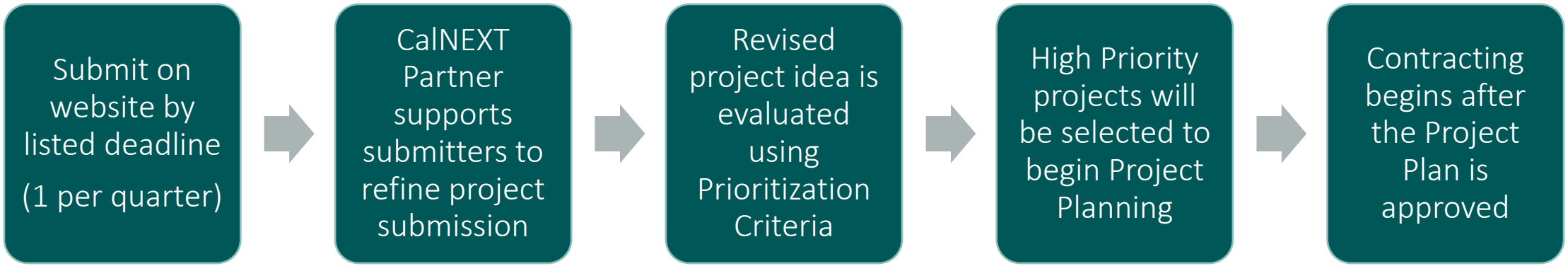
(3) Time-valuation of energy
[Rewards demand response and demand flexibility]



CPUC (D 21-05-031 R. 13-11-005)

CalNEXT Scanning & Screening

High Level Project Selection Process



Prioritization Criteria

Criteria	Weighting	Details
Quality of Idea	50%	Clarify of scope, how innovative it is, whether it's ready for implementation, has a clear market strategy, and has a reasonable timeline
Cost	5%	Estimated budget
TPM Alignment & Tech Transfer	25%	How well the project aligns with the CalNEXT TPMs or specific tech transfer opportunities
Benefits	20%	Whether the project has benefits for the utilities and affects HTR/DACs

Project Quality & Cost

Scope & Project Clarity (15%)

- What will you do?
- How will you do it?
- What do you expect to happen?

Justification/ Innovation (15%)

- Why is this different from work that has been done?
- What is the estimated value of the contribution?

Market Strategy & Awareness (5%)

- Who is this for?
- Who influences them?
- How do you know?
- How do you engage them?

Readiness (10%)

- How ready are you to start research?
- What resources and partners are in place?
- Why do you think you are positioned for success?

Timeline (5%)

- How long will it take to complete the scope?
- How does this compare to industry standards?

Cost (5%)

- How much will it cost to complete the scope?
- How does this compare to industry standards?

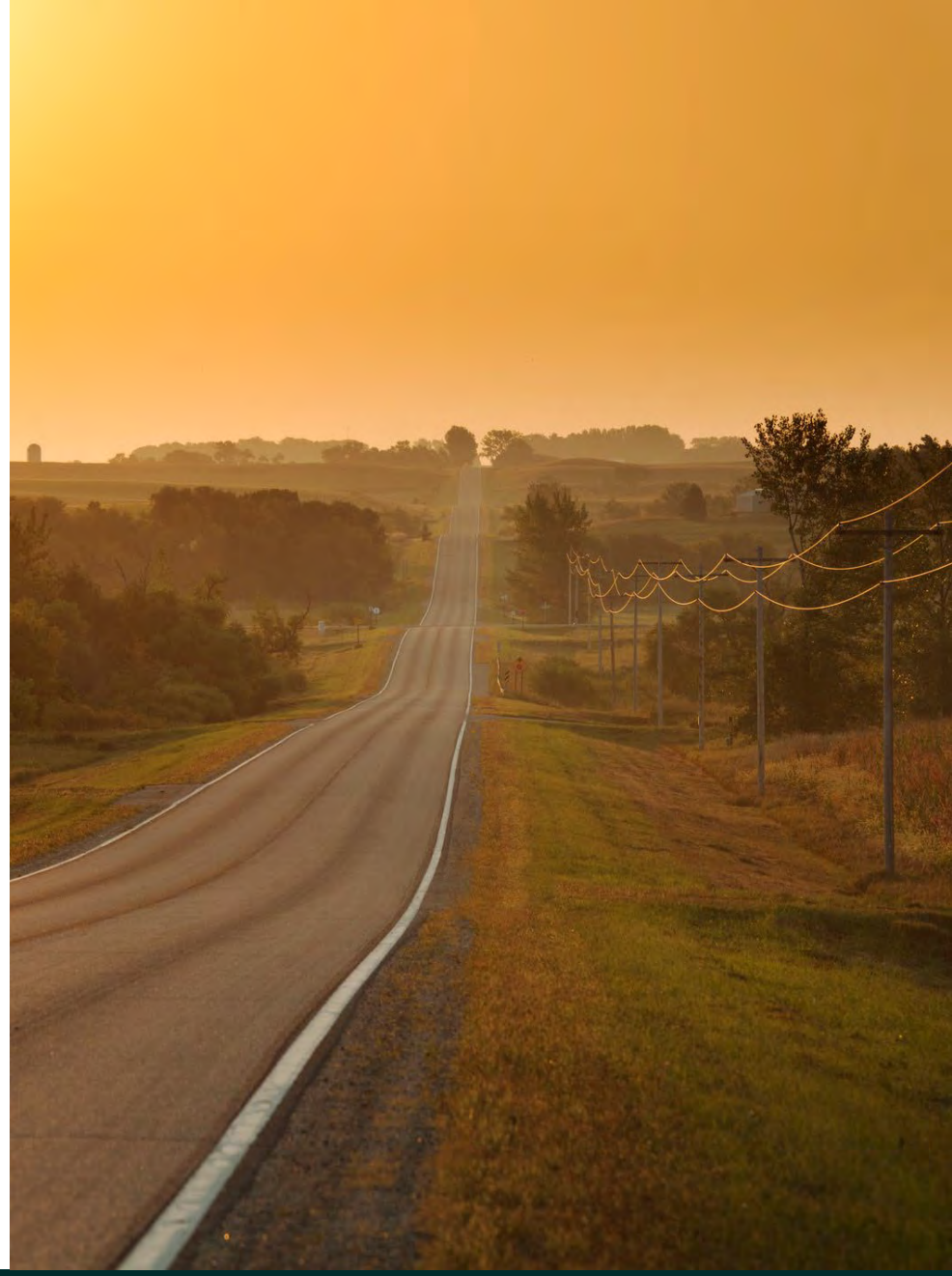
Benefits

Utility Company Benefits (10%)

- Meeting specific energy efficiency target
- Demand reduction during peak
- Grid flexibility
- Reducing operating costs
- Meeting clean energy goals

Disadvantaged Community (DAC) / Hard-to-Reach Community (HTR) Benefits (10%)

- Site located in DAC CalEnviro Screen area
- Works with CBOs and/or diversity advocates
- Develops outreach materials in many languages
- Utilizes diverse contractors
- Supports/utilizes workforce development programs
- Addresses impacts on vulnerable communities
- Engages with diverse working groups for feedback/partnership



TPM Alignment/Portfolio Priority

Technology Priority Map (TPM) Priority (15%)

- Project aligns with the priorities described in the CalNEXT Technology Priority Maps (TPMs)

Technology Transfer and Program Alignment (10%)

- Integration into Energy Efficiency (EE)/Demand Side Management (DSM) portfolios
- Establishes a market and/or a direction to increase technology adoption
- Real potential for energy savings
- Adequate market maturity

What are the TPMs?

High-Level Framework

Explains the CalNEXT program priorities with annual updates, sorted into six technology categories

External Communications Tool

Defines what CalNEXT wants to research with actionable guidance for the types of research projects we want to see.

Internal Tool for Screening

15%+ of ET project screening is based on alignment with TPMs.

Technology Priority Maps Overview

TPMs were started in 2017 by SCE's Emerging Technologies Program and were highly influenced by NEEA's ET program. They are a living document, needing periodic adjustments to keep up with dynamic changes in technology, policy, and other market drivers.

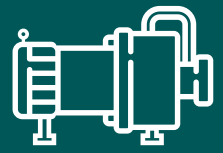
Whole Buildings

Water Heating

HVAC

Lighting

Appliances & Plug Loads



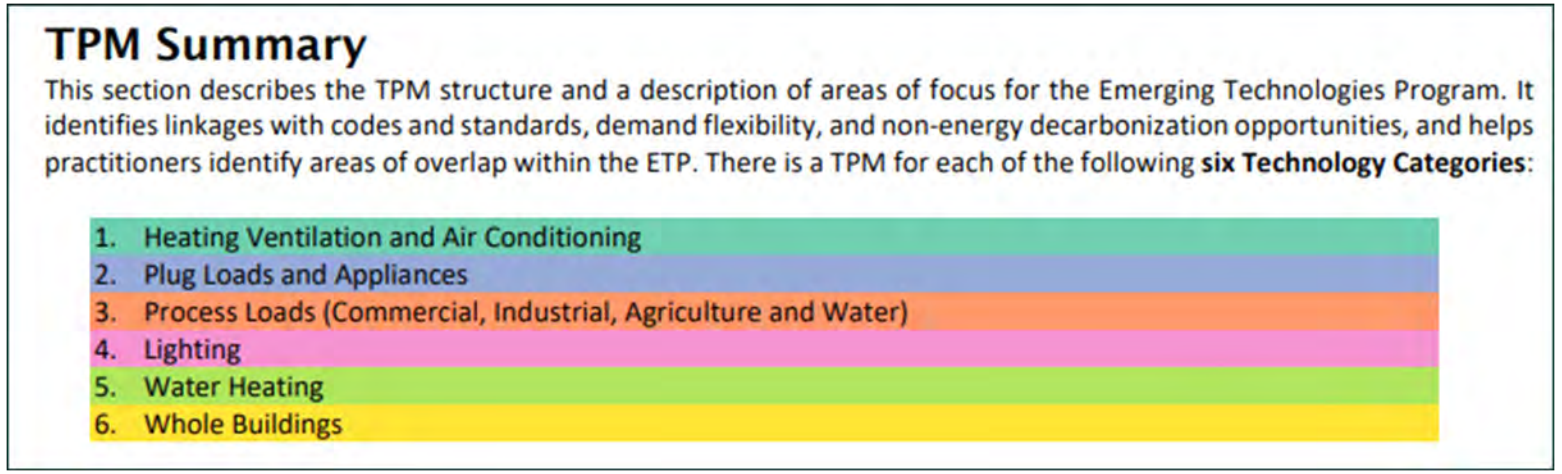
Process Loads

2022 TPMs

Organized into six TPM categories

- 46 Technology Families
- 200+ Technology subgroups

(see link for details)



TPM Summary

This section describes the TPM structure and a description of areas of focus for the Emerging Technologies Program. It identifies linkages with codes and standards, demand flexibility, and non-energy decarbonization opportunities, and helps practitioners identify areas of overlap within the ETP. There is a TPM for each of the following **six Technology Categories**:

1. Heating Ventilation and Air Conditioning
2. Plug Loads and Appliances
3. Process Loads (Commercial, Industrial, Agriculture and Water)
4. Lighting
5. Water Heating
6. Whole Buildings

- Highlight CalNEXT's priorities
- Details on types of research CalNEXT wants to fund
- Updated annually
- 2022 TPMs became effective on March 1, 2023

2022 HVAC TPM

2022 Technology Research Areas	Role	Priority	
High-Efficiency HVAC Heat Pumps	LEAD	HIGH	+
Scalable HVAC Controls Deployment	LEAD	HIGH	+
Hybrid or Fully Compressor-less HVAC	LEAD	HIGH	+
Heat Pump Market Transformation	LEAD	HIGH	+
HVAC Design for Decarbonization	LEAD	HIGH	+
Scalable Thermal Storage	LEAD	MEDIUM	+
Installation, Operations & Maintenance	LEAD	MEDIUM	+
110V/120V Heat Pumps	COLLABORATE	MEDIUM	+
Refrigerant Management & Low GWP Transition	COLLABORATE	MEDIUM	+

https://calnext.com/resources/hvac/

2022 HVAC TPM

2022 Technology Research Areas	Role	Priority	
High-Efficiency HVAC Heat Pumps	LEAD	HIGH	+
Scalable HVAC Controls Deployment	LEAD	HIGH	+
Hybrid or Fully Compressor-less HVAC	LEAD	HIGH	+
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HVAC Design for Decarbonization	LEAD	HIGH	+
↑ Scalable Thermal Storage	LEAD	MEDIUM	+
Installation, Operations & Maintenance	LEAD	MEDIUM	+
↑ 110V/120V Heat Pumps	COLLABORATE	MEDIUM	+
Refrigerant Management & Low GWP Transition	COLLABORATE	MEDIUM	+

https://calnext.com/resources/hvac/

After our TPM working groups this year, we are raising the priority of Scalable Thermal Storage and 110V Heat Pumps.

2022 HVAC TPM

High-Efficiency HVAC Heat Pumps

LEAD HIGH +

Compressor-based packaged equipment that can provide efficient heating (and potentially cooling). Systems may include air-to-air packaged heat pump units (ducted unitary heat pumps and ducted or ductless split systems), air-to-water heat pumps used to replace traditional boiler hydronic systems, or VRF. "High-efficiency" equipment typically contains variable speed (VS) fans, compressors, and/or pumps. Other pathways to high efficiency include advanced heat exchangers and advanced controls algorithms.

EXAMPLE TECHNOLOGIES

Air-to-water heat pumps for space heating, air-to-air heat pumps for space heating and cooling, VRF, and split system packaged heat pumps.

OPPORTUNITIES

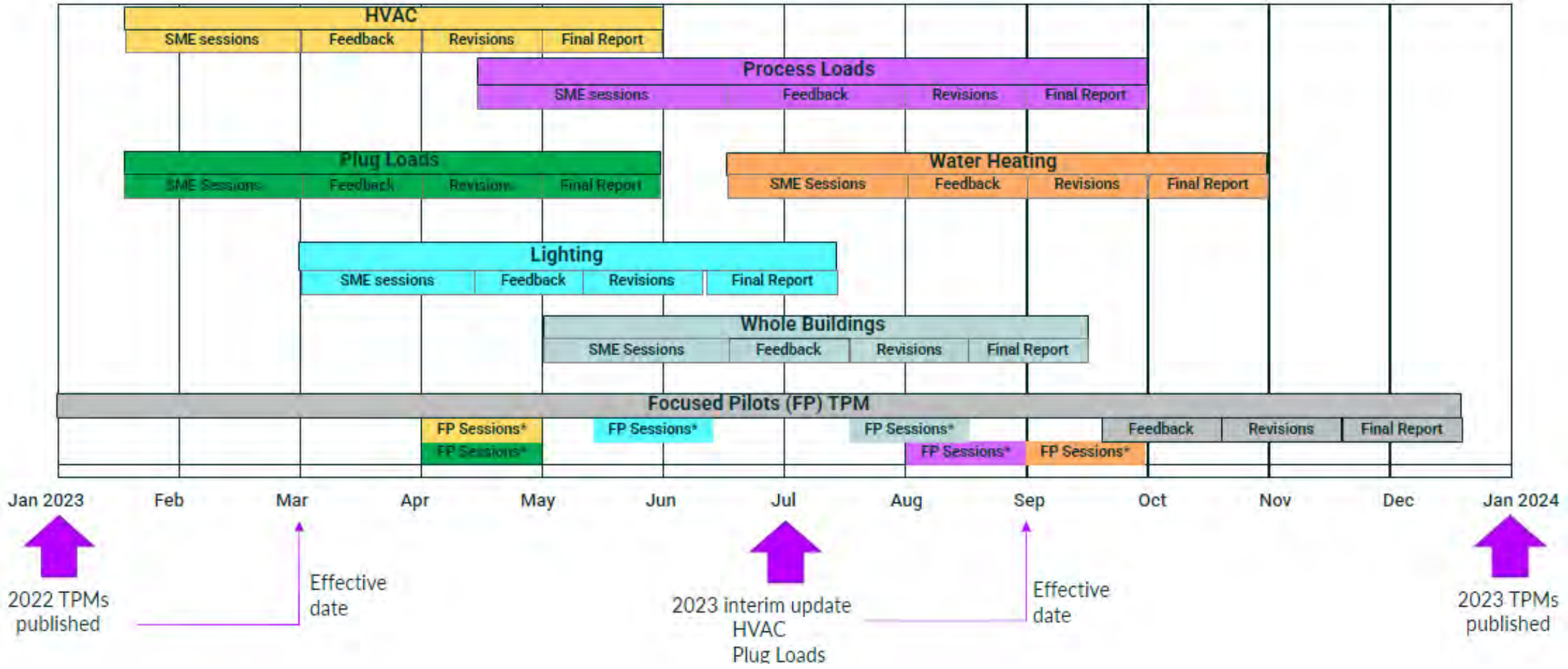
High-efficiency heat pumps present significant energy efficiency and decarbonization potential relative to fixed-speed equipment with traditional gas-fired heating. Variable speed compressors also enable more robust demand flexibility. Generally, any heat pump replacing a furnace or boiler will result in improved local air quality and potentially indoor-air quality through avoided gas combustion which may be a consideration for Disadvantaged Communities (DAC) and Hard-to-Reach (HTR) communities. Prospective research should focus on fields demonstrating high efficiency heat pump performance, especially when in heating mode to validate product efficiency, heating capacity, product sizing, and the related heating-performance metrics.

BARRIERS

Packaged heat pumps are a well-researched field with mature ratings systems and testing methods. Despite this maturity, the current test procedures do a poor job of capturing the real-world performance of variable speed equipment (part-load cooling, mild heating scenarios, and cold climate performance). This can lead to significant uncertainty in real-world performance, especially since the majority of time these products are operating in California's relatively mild climate. Continued research on these products will be helpful to ensure right-sizing of products and may help programs fully account for the known benefits of high efficiency, variable speed products.

2023 TPM Schedule

Opportunities for feedback



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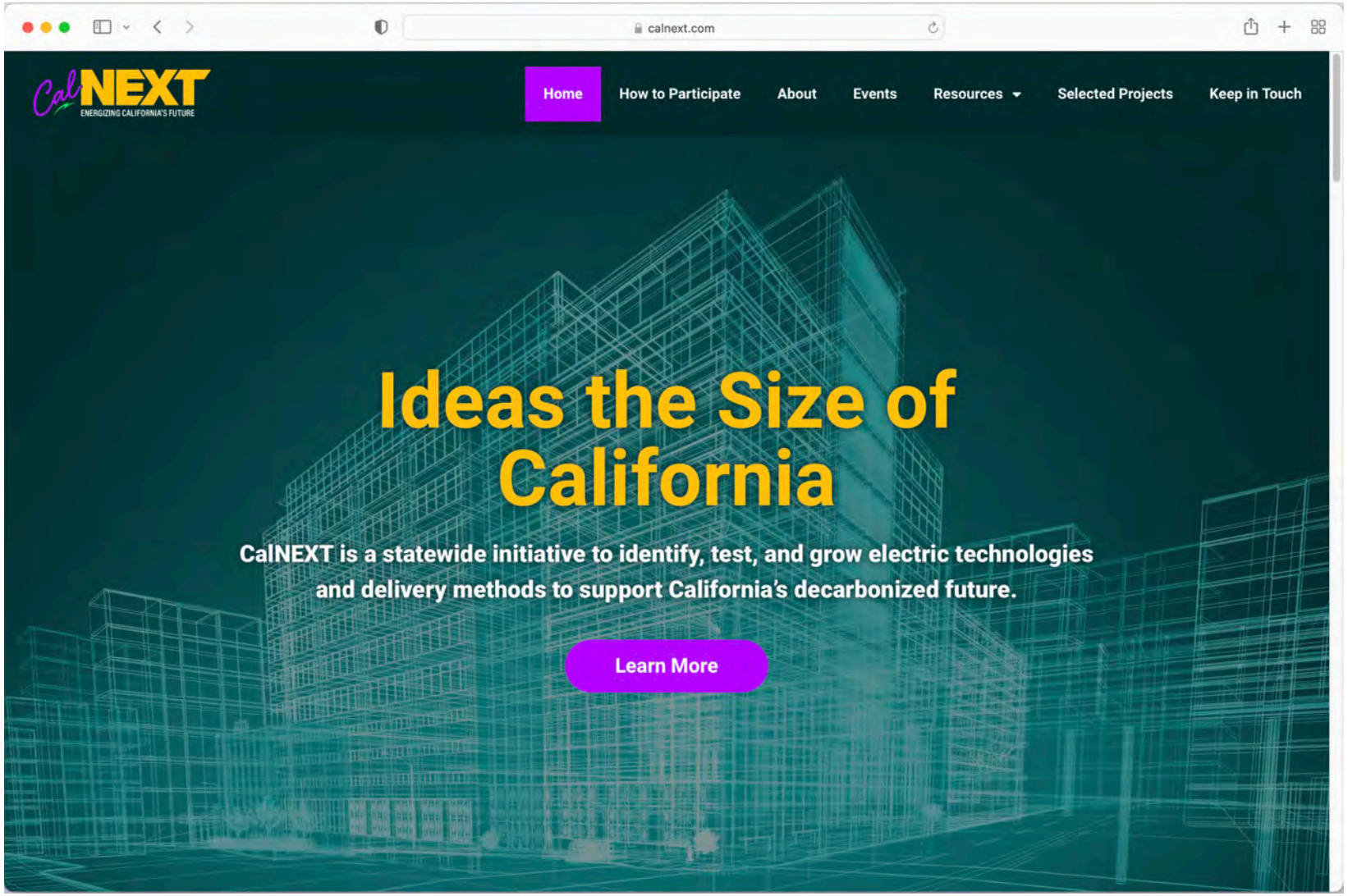
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Ideas the Size of California
CalNEXT is a statewide initiative to identify, test, and grow electric technologies and delivery methods to support California's decarbonized future.
Learn More

Submit an Idea

For project concepts that are not fully defined:

(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.)

CalNEXT Idea Submission Form

1. Submission Date

06/23/2023

2. Idea Name

3. Company or Organization Name

4. Contact Name

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

PROJECT TEAM INFORMATION

1. Submission Date *

06/23/2023

2. Project Name *

Please limit the Project Name to 5 words or less

3. Company or Organization Name *

Approved Projects

Projects that have been reviewed by the CalNEXT Program team using our review criteria and accepted by the Program Administrator are listed here. Statuses will be updated at least monthly and Final Reports will be linked when available.

Projects are filterable by Technology Area (based on the TPMs) and Project Type. They are also sortable by any column and searchable by any keyword.

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

Technology Area | Project Type

Search:

Project Name	Project Number	Technology Area	Project Type	Status
▸ All-Electric Commercial Kitchen Electrical Requirements Study Evaluation	ET22SWE0010	Process Loads	TSR	Complete Final Report
▸ Commercial and MF CO2-based Heat Pump Water Heater Market Study and Field Demonstration	ET22SWE0017	Water Heating, Whole Buildings	TSR	Active

Submission Next Steps

Selected Projects 2023

Through June 23, 2023

TPM Area	Selected Projects
HVAC	**Comfort Impacts of Partial Coverage of ASHPs**
	Field Evaluation of Ultra-Efficient, Compressor-less, Packaged Rooftop Unit with Integral Energy Storage
	Occupant-Centric Micro-Zone Control for Commercial Buildings
	Ultra-Low GWP Space Conditioning Heat Pumps for Commercial Buildings
	Heat Pump Crankcase Heat Management (Fast Track)
	Integrated HVAC RTU Remote Monitoring Systems
	Double Duct Packaged Terminal Heat Pump Field Demonstration

Some projects under review were scored in Q4 2022 so numbers may not align exactly with Q1 project numbers in previous slides.

Selected Projects 2023

Through June 23, 2023

TPM Area	Selected Project
Whole Building	**Residential Multi-Function Heat Pump: Laboratory Testing**
	Manufactured Housing Electrification Measure Development Support
	AMI Intelligence Connected Building Energy Modeling
	Residential Windows Measure Package Update (Fast Track)
	Characteristics of Energy Efficiency Emerging Technologies for Wineries
	Enhanced Normalized Metered Energy Consumption Analysis with Rapid Interventions

Some projects under review were scored in Q4 2022 so numbers may not align exactly with Q1 project numbers in previous slides.

Selected Projects 2023

Through June 23, 2023

TPM Area	Selected Projects
Plug Loads & Appliances	**120V Induction Stoves with Battery Back-Up**
	Benchtop Efficiency Measurements for Residential mesh Networking Equipment
Process Loads	**Industrial Heat Pump Market Study**
	Characteristics of Energy Efficiency Emerging Technologies for Wineries
	Wastewater Treatment Biosolids Management Technology Demonstration
Water Heating	**Overcoming Key Barriers to Electrification of Foodservice Hot Water in California**
	Residential HPWH Market Study and Measure Gap Analysis (Fast Track)

Some projects under review were scored in Q4 2022 so numbers may not align exactly with Q1 project numbers in previous slides.

Approved Projects

Through June 23, 2023

TPM Area	Selected Projects
Whole Building	**Commercial Windows Market Study and Workpaper Development**
Whole Building	**Residential Electrical Service Upgrade Decision Tool**
Whole Building	**Mobile and Manufactured Housing Market Characterization Study**
HVAC	**HVAC Thermal Energy Storage System (TESS) Field Evaluation**
Process Loads	Onsite Wastewater Treatment and Process Water Recycling Systems for Ag Dairy Farms
Water Heating	Emergency Replacement Heat Pump Water Heater Market Study
HVAC	Water-Cooled Chillers Market Assessment & Performance Evaluation
HVAC	eTRM Adjustments for No-cooling Baseline Options for Smart T-stat, Heat Pump HVAC Measures

Some projects under review were scored in Q4 2022 so numbers may not align exactly with Q1 project numbers in previous slides.

2022 Approved Projects – All TDRs

Projects approved through 3/31/23

Project Name	Implementer	Expected Completion
Residential Multi-Function Heat Pumps: Product Search	**UC Davis**	**2022**
Hybrid Heat Pump and Indirect Evaporative Cooling Packaged Unit (Hybrid RTU)	UC Davis	2024
Aerosol Sealing of Existing Attics and Crawlspaces (PG&E)	UC Davis	2024
REA Systems - Market Study	UC Davis	2024
Residential Multi-Function Heat Pumps: Heat Exchanger Improvement	UC Davis	2024
Performance Evaluation of Advanced HEMS	UC Davis	2025

* Includes utility name if there is a site installation in territory

2022 Approved Projects – All TDRs

Projects approved through 3/31/23

Project Name	Implementer	Expected Completion
Solar Assisted HVAC Market Study	AESC	2022
Market Potential for Heat Pump Assisted Hot Water Systems in Food Service Facilities	**TRC**	**2023**
Advanced Multifamily EV Load Management System (PG&E)	Energy Solutions	2023

* Includes utility name if there is a site installation in territory

2022 Approved Projects – All TSRs

Projects approved through 3/31/23

Project Name	Implementer	Expected Completion
Occupancy-based Thermostats for Commercial Offices (SDG&E)	AESC	2022
Wastewater Treatment SB1383 Compliance Characterization	AESC	2023
Commercial and MF CO2 based Heat Pump Water Heater Market Study and Field Demonstration (PG&E)	AESC	2024
Packaged Central CO2 Heat Pump Water Heater Multifamily Demonstration (PG&E)	AESC	2024
Compressed Air End-Use Air Management System (PG&E, SDG&E)	**AESC**	**2024**
High Efficiency Dehumidification System Field Study (TBD)	AESC	2025

* Includes utility name if there is a site installation in territory

2022 Approved Projects – All TSRs

Projects approved through 03/31/23

Project Name	Implementer	Expected Completion
Residential Housing Characteristics Study	**Ortiz Group**	**2023**
Swimming Pools as Heat Sinks for Air Conditioners (PG&E)	UC Davis	2024
Lab Evaluation of Integrated Controls for Commercial Buildings	UC Davis	2025
PoE Microgrids for Commercial Buildings Lab Evaluation	UC Davis	2025
Master Mixing Valve Field Study (SDG&E)	TRC	2024

* Includes utility name if there is a site installation in territory

2022 Approved Projects – All TSRs

Projects approved through 03/31/23

Project Name	Implementer	Expected Completion
Residential Water Heater Sizing Measure Package Support	TRC	2022
Standardized HVAC Sequence of Operations	**TRC**	**2024**
Commercial Kitchen Hot Water System Design Guide	**TRC**	**2024**
Restaurant Field Monitoring (SDG&E)	TRC	2025
Field Study of HVAC Cost Optimized Supply Air Temperature Reset (CORE) (TBD)	TRC	2025
ASHRAE Guideline 36 Open Source Supervisory Control Technology Development and Demonstration (PG&E)	**TRC**	**2026**

* Includes utility name if there is a site installation in territory

2022 Approved Projects – All TSRs

Projects approved through 03/31/23

Project Name	Implementer	Expected Completion
Low-Income Multifamily Housing Characteristics	**VEIC**	**2023**
Variable Refrigerant Flow (VRF) Refrigerant Management Market Assessment	VEIC	2023
Next Generation Refrigeration Analysis Tool Proof of Concept	VEIC	2023
Multifamily In-Unit Heat Pump Market Study	**VEIC**	**2023**
Market Study of Household Electric Infrastructure Upgrade Alternatives for Electrification	VEIC	2023
Technical Evaluation of Air-to-Water Heat Pumps (PG&E)	**VEIC**	**2024**

* Includes utility name if there is a site installation in territory

2022 Approved Projects – All TSRs

Projects approved through 03/31/23

Project Name	Implementer	Expected Completion
All-Electric Commercial Kitchen Electrical Requirements Study Evaluation	**Energy Solutions**	**2022**
Greenhouse Lighting Controls (PG&E)	Energy Solutions	2023
Increasing Heat Pump Water Heater Deployment	Energy Solutions	2023

* Includes utility name if there is a site installation in territory

Focused Pilots

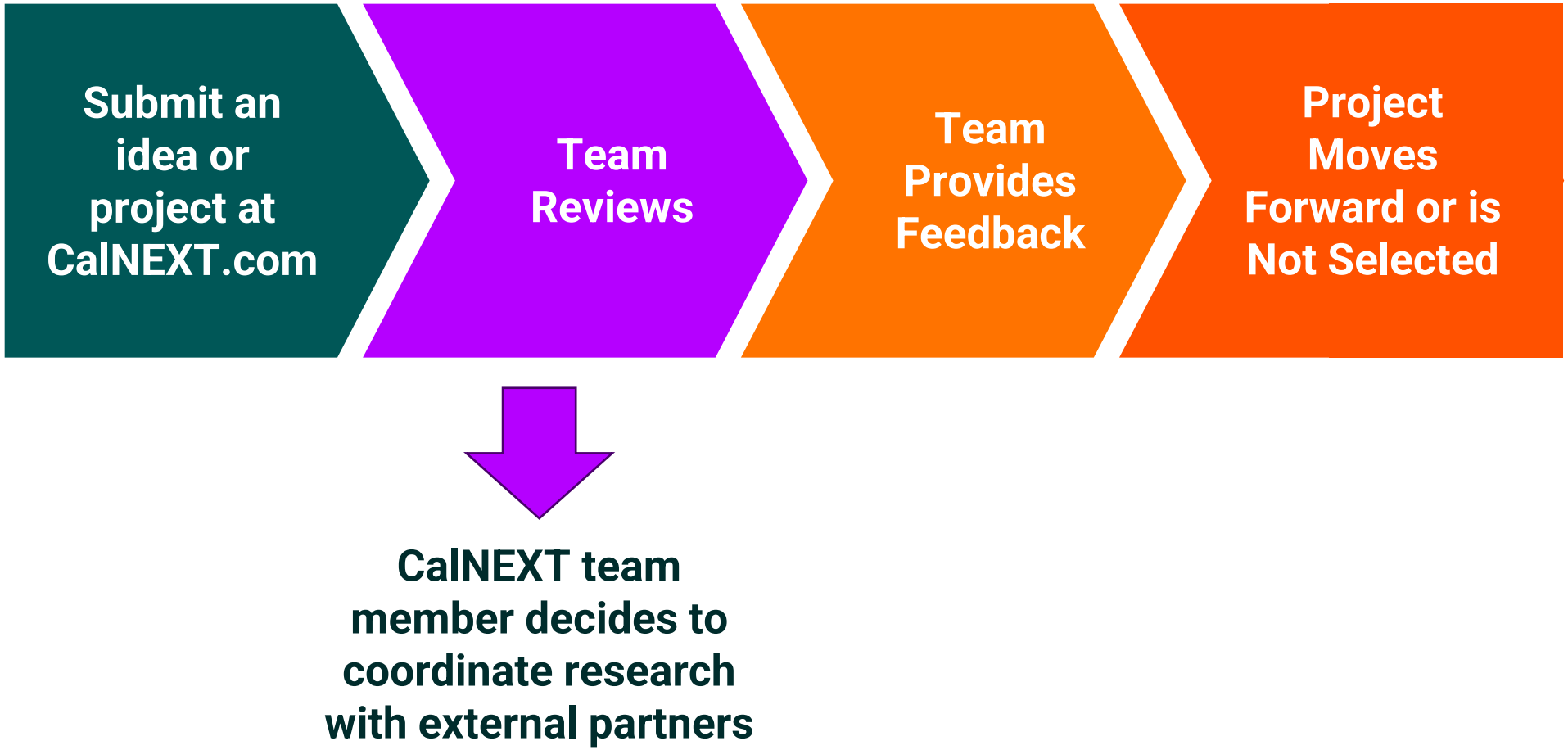
Focused Pilot projects (in process)

TPM Category	Technology Family	Primary objectives of Focused Pilot
Process Loads	Commercial Refrigeration	Fill TRM Gap on High Efficiency Evaporators & Condensers
HVAC	High Efficiency Heat Pumps for Space Heating and Cooling	Investigate light commercial market & deploy Heat Pumps
Water heating	Residential-Duty Water Heating	Activate supply chain: focus on converting electric resistance WH sales to HPWH.
Process Loads	Advanced Motors	Market support & education for advanced motors (1 to 50 horsepower) for built-up HVAC systems: fans and pumps. Investigate changes to existing fan & pump measures to support transition to Advanced Motors

Partnership and Collaboration

Ways to Partner

Ways to Partner



Partner Team

Energy Solutions

veic

aesc
alternative energy systems consulting

ORTIZ
THE ORTIZ GROUP

TRC

UC DAVIS
UNIVERSITY OF CALIFORNIA

Thank You!

Tim Minezaki

tminezaki@energy-solution.com

Break

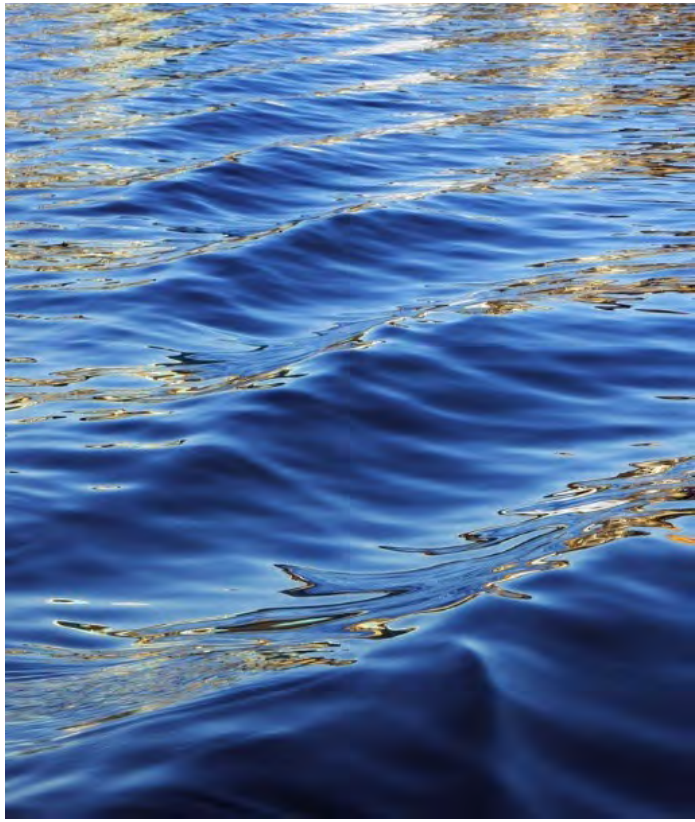
Agenda

9:00 am	Welcome, Agenda Review, Announcements, Conferences & Product Council Updates
9:45 am	*New!* California IOU Emerging Technology Update
11:15 am	*Break (15 min)*
11:30 am	*New!* Snohomish PUD Emerging Technology Update
12:00 pm	*Lunch (60 min)*
1:00 pm	*New!* 2023 Scanning Projects
2:00 pm	*New!* Dual-Fuel Technology
3:00 pm	Public Comment, Poll & Adjourn

Snohomish PUD Emerging Technology Update

Innovation at Snohomish PUD

June 27, 2023



Snohomish PUD

338,130 residential and 34,885 commercial/industrial customers

2200 square miles in Snohomish County and Camano Island

2022 energy efficiency equaled enough power for 11,000 EVs

BPA's largest Customer

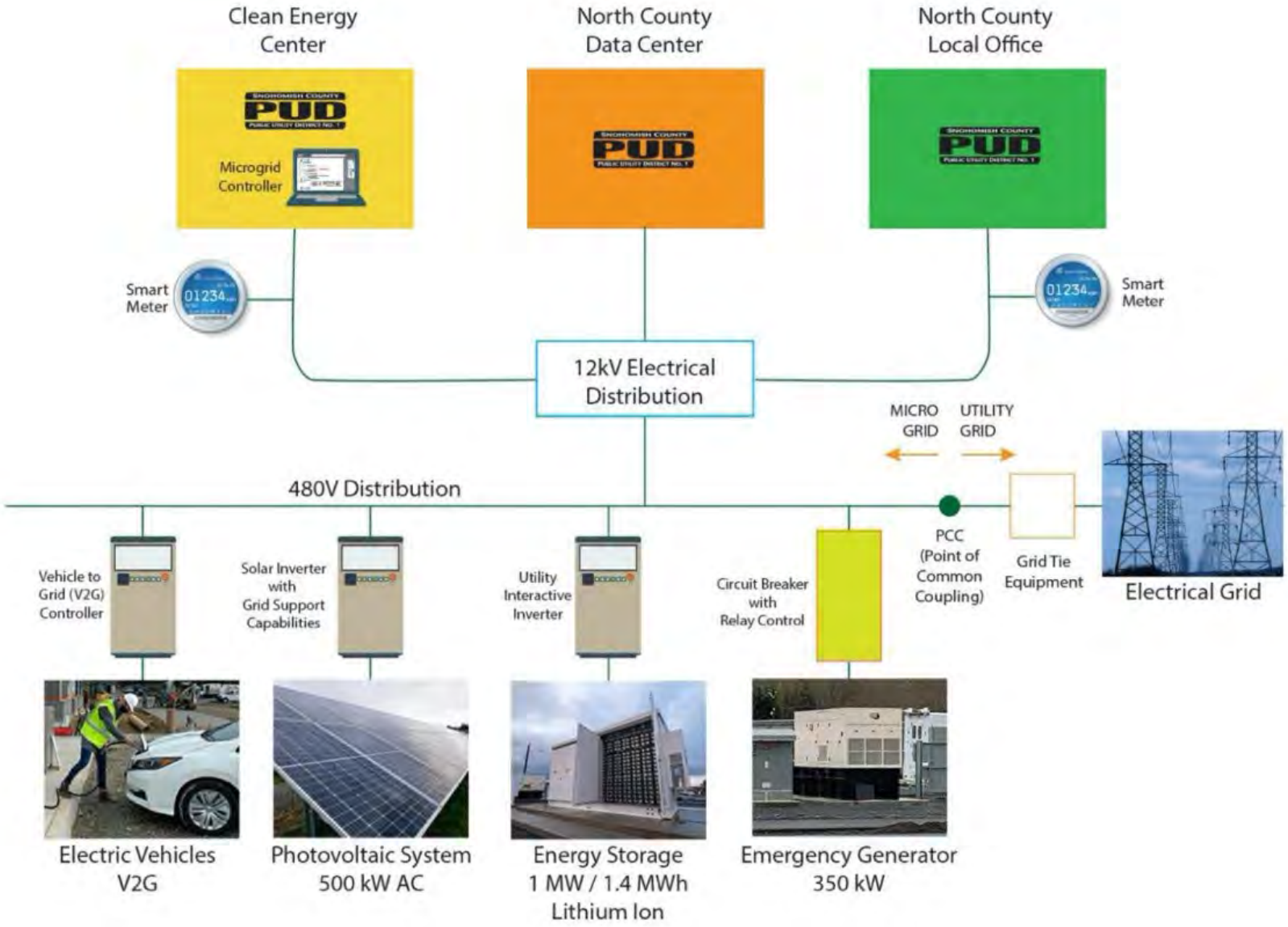
Large Customers include Boeing, Navy, Providence Medical and Hampton Lumber

APPA Smart Energy Provider

- Resource portfolio minimizing GHGs
- Investment and participation in research
- Planning, partnerships and stakeholders
- Portfolio of programs for EE, EVs, DR, DER, equity
- Environmental and sustainability initiatives
- Customer Experience

Surprise Response: "Does your utility track GHG emissions savings from smart energy programs?" ....no.

Arlington Microgrid



Microgrid Benefits

- **Grid Resiliency and Disaster Recovery**
  - Provide partial back-up power to the Clean Energy Technology Center, a back-up data center and a future local office (under construction). A 25MW utility scale battery is in the planning phase.
- **Community Solar**
  - Ten percent to income qualified and second site in Everett under development with 100% income qualified with potential battery storage.
- **Grid Support and Ancillary Services**
  - Connected to the PUD's other two remote energy storage systems via DERO (Distributed Energy Resource Optimizer) – peak shaving, solar smoothing, energy arbitrage, congestion relief
- **V2G (Vehicle-to-Grid)**
  - Demonstrate how PUD's electric fleet vehicles can be used to provide support to the microgrid.

Load Flexibility

- FleetCarma EV Charging with year 1 data collection and year 2 incentives for seasonal off-peak charging
- Flex Energy Pilot (EV Chargers and Thermostats)
- BPA/PGE CTA-2045 water heater demand response
- EPRI cold climate heat pump with CTA-2045 demand response
- Commercial Time of Use pilot
- New Construction Energy Design Assistance for early intervention with incentives for EE performance, demand reduction and income qualified
- Electric transportation portfolio of customer programs including fleet planning with our own fleet participating and a 10-year transition plan.

Load Flexibility Lessons Learned

- Lessons Learned
  - Utility need vs implementation cost
  - Creating the value stream – EE plus load flexibility plus locational need
  - Easy to understand and minimize choice
  - Minimize customer impact and interaction
  - Device interoperability needed
- Next Steps
  - TOD rollout with AMI deployment
  - Electrification planning with home developers and municipalities

Electric Vehicles

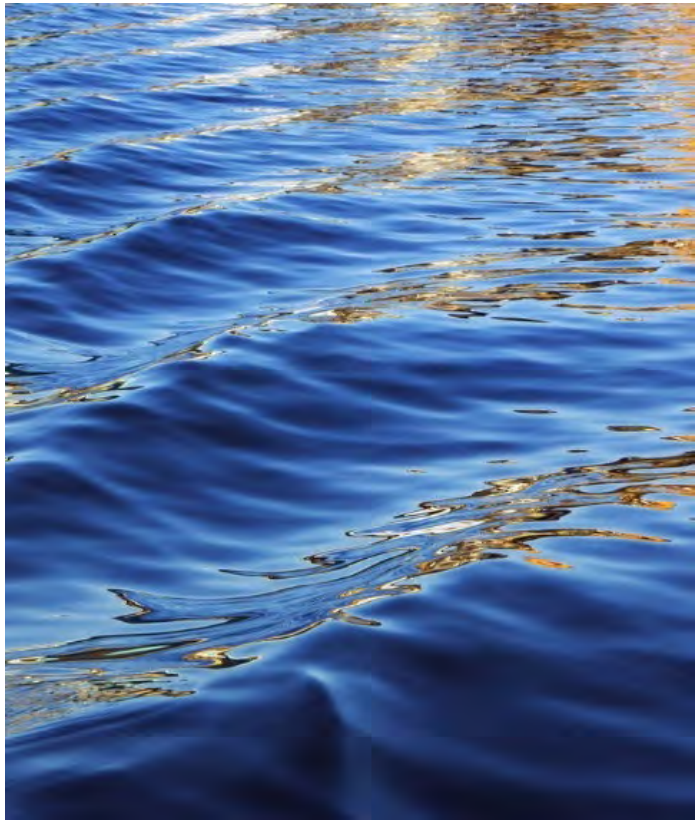
- CEF grant for DCFC at headquarters and transitional housing/job training facility.
- En-route induction charger for the City of Everett under development.
- Everett Transit/Batt Genie recycling King County Metro batteries for off-peak battery charging and peak bus charging.

Research and Innovation

- NEEA RETAC
- BPA Emerging Technologies
- EPRI
  - Grid Edge Customer Technologies
  - Electric Transportation
  - Technology Innovation Advisory Council
- WA Dept of Commerce Clean Energy Funding (CEF)
- Customer Partnerships
- Innovative Customers
  - Helion Energy – Fusion power plant contracted with Microsoft in 2028
  - Eviation – Alice Electric plane flight from Moses Lake
  - MagniX – electric propulsion for aircraft
  - Zero Avia – partnered with Alaska Air

Questions?

Suzanne Frew, P.E.
SFrew@snopud.com



Lunch

2023 Scanning Projects

Consumer Products

- Continuation of Laundry Field Study
- Continuation of television standards advancement
- Commercial display and monitor testing (planning)
- Commercial HP dryer with desiccant (planning)
- New HP dryer model testing
- Laundry center & combo washer-dryer unit testing (planning)
- Smart Home Energy Management research (planning)

Building Envelope & Whole Building

- High Performance Windows Partnership for Advanced Window Solutions (PAWS) collaboration
- Commercial secondary window field studies
- VIP exterior panels (planning)
- Electro-chromatic films (planning)
- BrainBox AI field study

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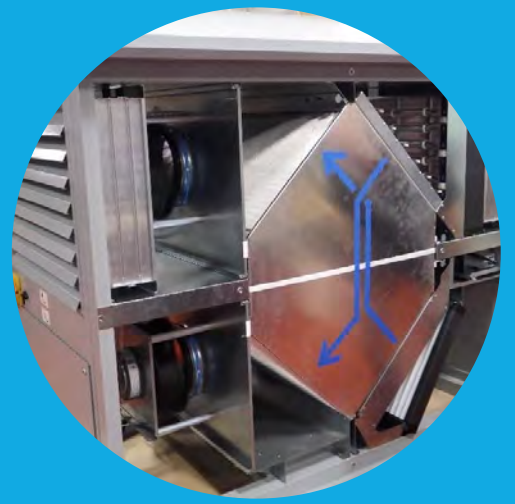
Commercial HVAC

- Very High Efficiency DOAS field studies
- Efficient RTU Field study (Gas)
- Gas engine heat pumps (gas, planning)
- Commercial gas HP modeling
- Very High Efficiency DOAS with hydronic integration (planning)



Lighting & Motor Driven Systems

- Lighting
  - LLLC field data collection
  - Exterior LLLC with integrated storage
  - LLLC with integrated HVAC control field study (planning)
- Motor Driven Systems
  - Commercial Adjustable Speed Drive market penetration study
  - Fan system energy savings with technology improvements (planning)

Water Heating

- Split-system HPWH scanning
- Central Commercial HPWH systems product assessment
- Multifamily central HPWH field study
- Large capacity CO_2 central HPWH field study
- EcoSim enhancements
- Combined hot water and space heating (gas)

Residential HVAC

- Micro heat pump user testing
- Field representativeness project
- VSHP features & capabilities analysis
- SPE07 repeatability testing
- Dual Fuel modeling
- Vicot GHPWH lab testing (gas)
- Advanced adsorption technology lab testing (gas)

ResHVAC

Christopher Dymond

3 ResHVAC Topics

- Heat Pump Improvements – Update
- Refrigerants and DR – Opportunity?
- Micro Heat Pump Field Study - Update

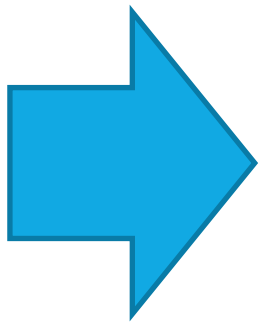
Variable Speed Heat Pump Program

(soon to be renamed)

- **Goal**: Continuously improve average installed efficiency and peak savings across all residential-size heat pump systems

Heat Pump Improvements

Heat Pump Improvements	Est. Energy Savings	Peak Savings	Carbon Savings	Value Prop
Improved Test Procedure	4%			
Higher Efficiency Standard	6%			
Low Load Efficient	6%	small	big	
Cold Climate Capable	10%	5+ kW	medium	+
Minimize Aux Heat	5%	medium	big	-
Connected Commisioning	5%		yes	+
No Duct Losses	6%	small	medium	+
Auto Demand Response	0%	medium	medium	
Adaptive Defrost	2.5%		small	
Drain Pan Heater	2%		small	
Standby Losses	2%		small	
Crankcase Heater	2%		small	



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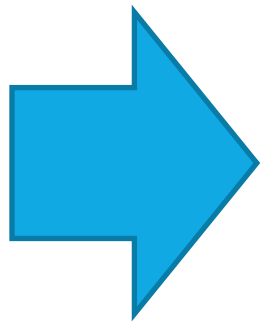


10-20% more savings & reduced peak impact

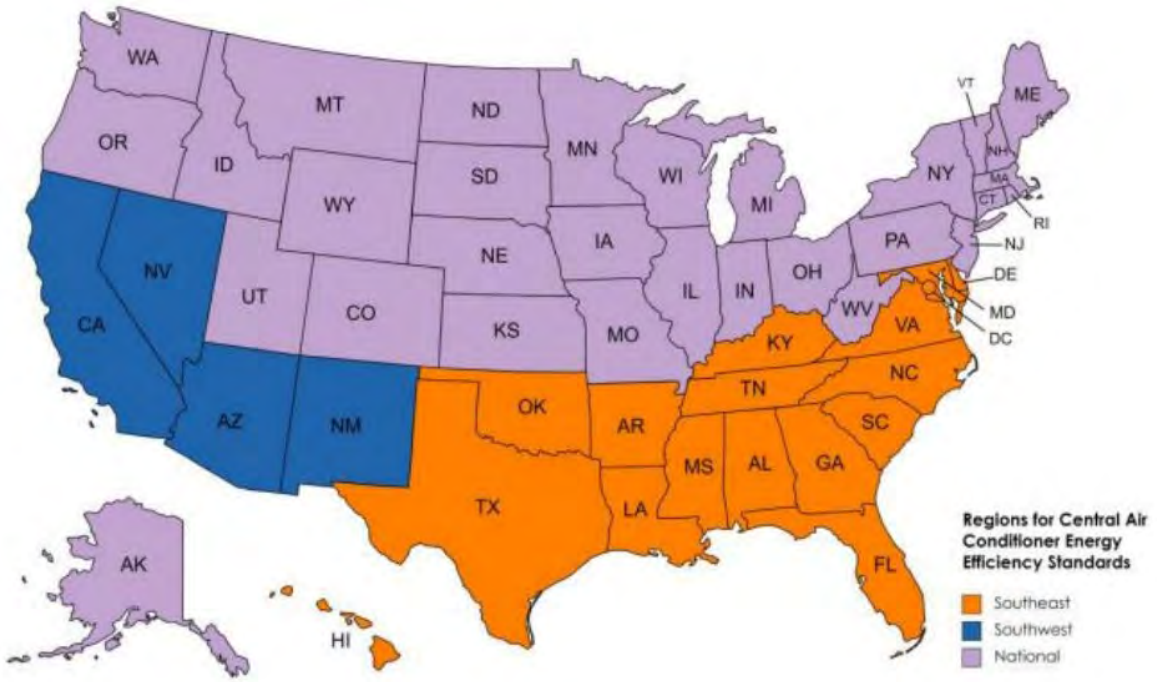
Impact occurs several years after influence

	Fed Tax Credit	Fed Standard
1. Increased Minimum Efficiency Requirements	-	2029
2. Low Load Efficient	2025	-
3. Cold Climate Capable (w/aux heat limits)	2025	-
4. Connected Commissioning	2028	-
5. No Duct Losses (aka multi-zone ductless)	2028	-
6. Auto Demand Response	2028	-
7. Other		
1. Improved defrost		2029
2. Better drain pan heaters		?
3. Reduced standby losses		?
4. Efficient crankcase heaters		?

Dates are best guesses, not guaranteed

North and South Tax Credits

- IRS has indicated to EPA staff that they view this CEE map as evidence that you can't get a tax credit for
  - south heat pumps installed in north
  - north heat pump installed in south
- Santa Fe is warm?
- Tacoma is cold?



CEE Tax Credit – Northern Climate

CEE Split Ducted ASHP Specifications – North and Canada						
Level	SEER2	EER2	HSPF2	COP at 5°F*	Capacity Ratio^	Connectivity
CEE Tier 1 Tax credit	≥ 15.2	≥ 10.0	≥ 8.1	≥ 1.75	≥ 58% at 17°F/47°F **or** ≥ 70% at 5°F/47°F	N/A
CEE Advanced Tier**	≥ 17.0	N/A	≥ 8.1	≥ 1.75		CEE Demand Response Criteria Level 2

CEE Non-Ducted ASHP Specification – North and Canada						
Level	SEER2	EER2	HSPF2	COP at 5°F*	Capacity Ratio^	Connectivity
CEE Tier 1	≥ 15.2	≥ 9.0	≥ 8.5	≥ 1.75	≥ 58% at 17°F/47°F **or** ≥ 70% at 5°F/47°F	N/A
CEE Tier 2 Tax credit	≥ 16.0	≥ 9.0	≥ 9.5	≥ 1.75		N/A
CEE Advanced Tier**	≥ 17.0	N/A	≥ 10.0	≥ 1.75		CEE Demand Response Criteria Level 2

Choosing the best heat pump depends on what you want to achieve

- PEAK SAVER - A cold climate HP with aux heat controls, is great for removing ER heat (but it is not cost effective from a customer perspective).
- ENERGY SAVER - A low load efficient heat pump with aux heat controls saves lots of energy (not necessarily efficient or high capacity at 5F).

Refrigerant Changes Arrive in 2025

- GWP limit for unitary HPs goes from ~2300 to 700
  - OEMs are not retesting current equipment
  - OEMs are updating products for 1/1/2025
- New Refrigerants are A2L (“mildly flammable”)
  - R-454B GWP = 466 will cost a lot more per pound*
  - R-32 GWP = 675 slightly better performance
- IMPACT - equipment that has high EER values may be constrained as they need more refrigerant

*conversations with OEMs, and refrigerant manufacturer

Shift in Focus Opportunity?

- What if there was an DR alternative to the EER requirement?
- A DR capable heat pump would cost less and save more during peak cooling hours
- **DISCUSION**: Should the region be focusing ET resources on demand response capabilities rather than EER2?

Micro Heat Pumps

Window AC

Portable

Saddlebag

C+C Research

- Phase 1
  - 40 potential participants drawn from 1000-person Online Community
  - Initial understanding (initial perceptions, candidate information)
- Phase 2
  - 13 Participants received units
  - Exercise #1 – capture installation experience
  - Exercises #2-5 – understand how they are used
- Final Report = NEEA Product Council Presentation
  - July 18th 10:30AM Pacific

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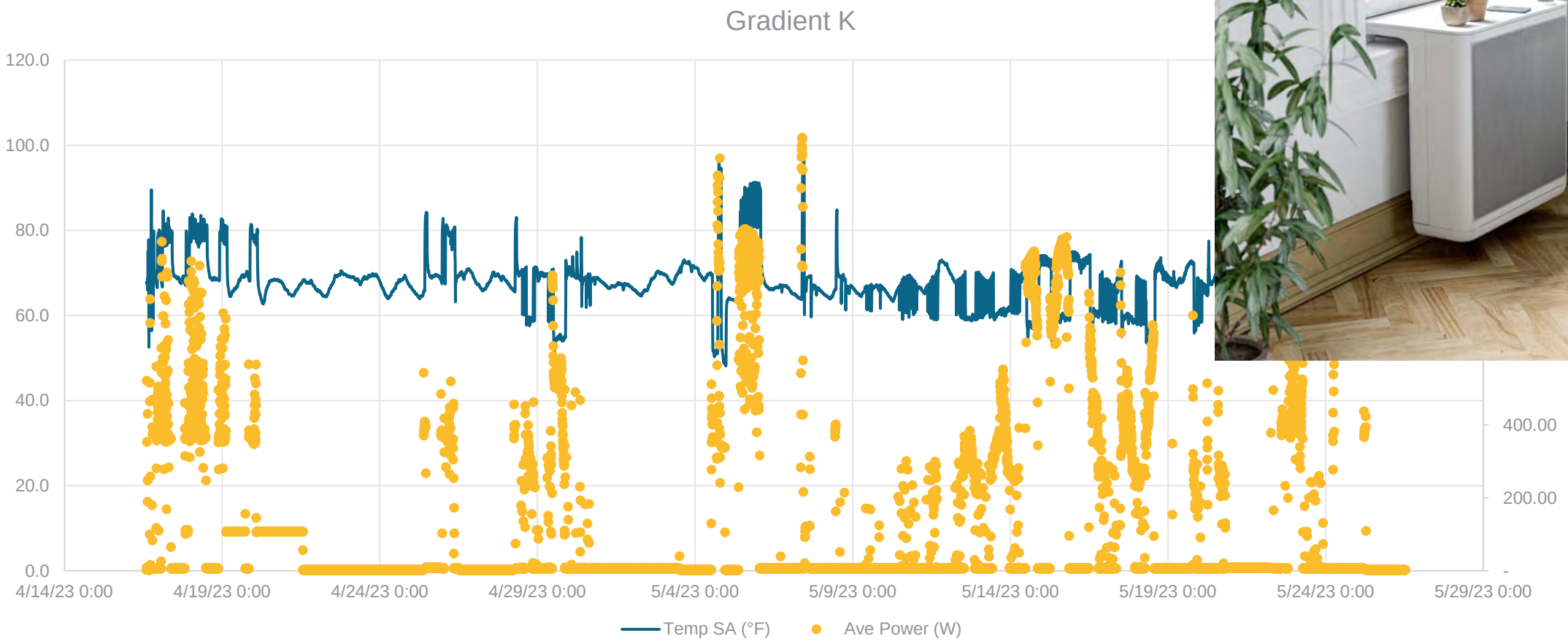
Field Testing – Early Teaser

- The product's ability to both heat and cool is well-liked by participants and most are impressed by how quickly the unit can heat or cool the room.
- Some noted they only heat/cool the room they are in
- Gradient was easiest to install (surprisingly)
- Some products require modifications (screwing in unit) which make them in questionable for renters

Window units were not used much

Saddle bag HPs were used more



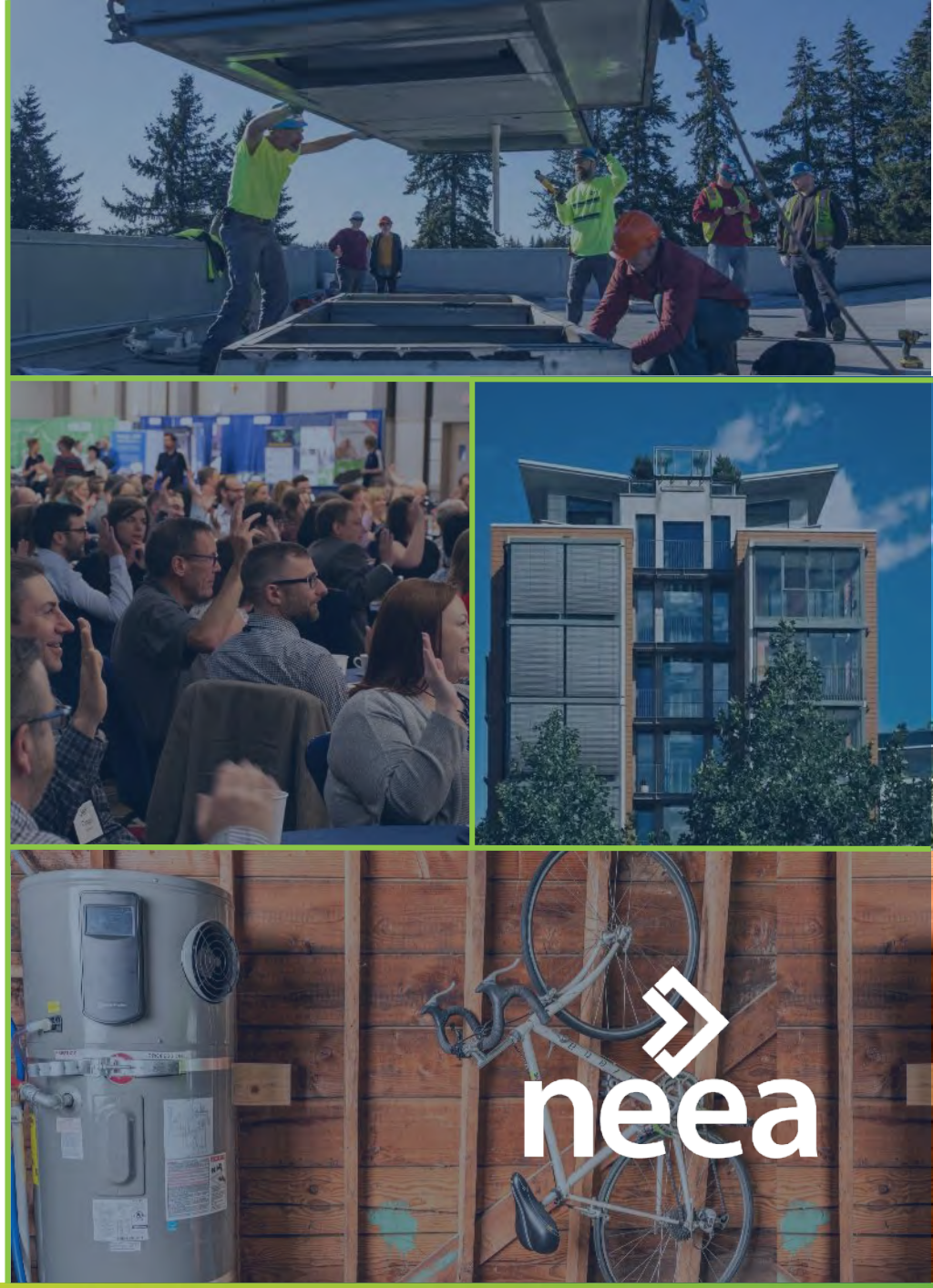
Dual-Fuel Technology

Dual Fuel Heating System

Energy Trust of Oregon, PSE, NEEA

June 2023

CLASSIFICATION LEVEL: PUBLIC



Agenda

- Technology
- Market Updates
- Northwest Codes and Policy
- Northwest Simulation Study
- Energy Trust of Oregon – Residential Dual Fuel Pilot Launch Framework
- PSE – Dual Fuel Pilot & Electrification Pilot
- Q&A

Overview of a Dual Fuel System

FURNACE

HEAT PUMP

CONTROLLER

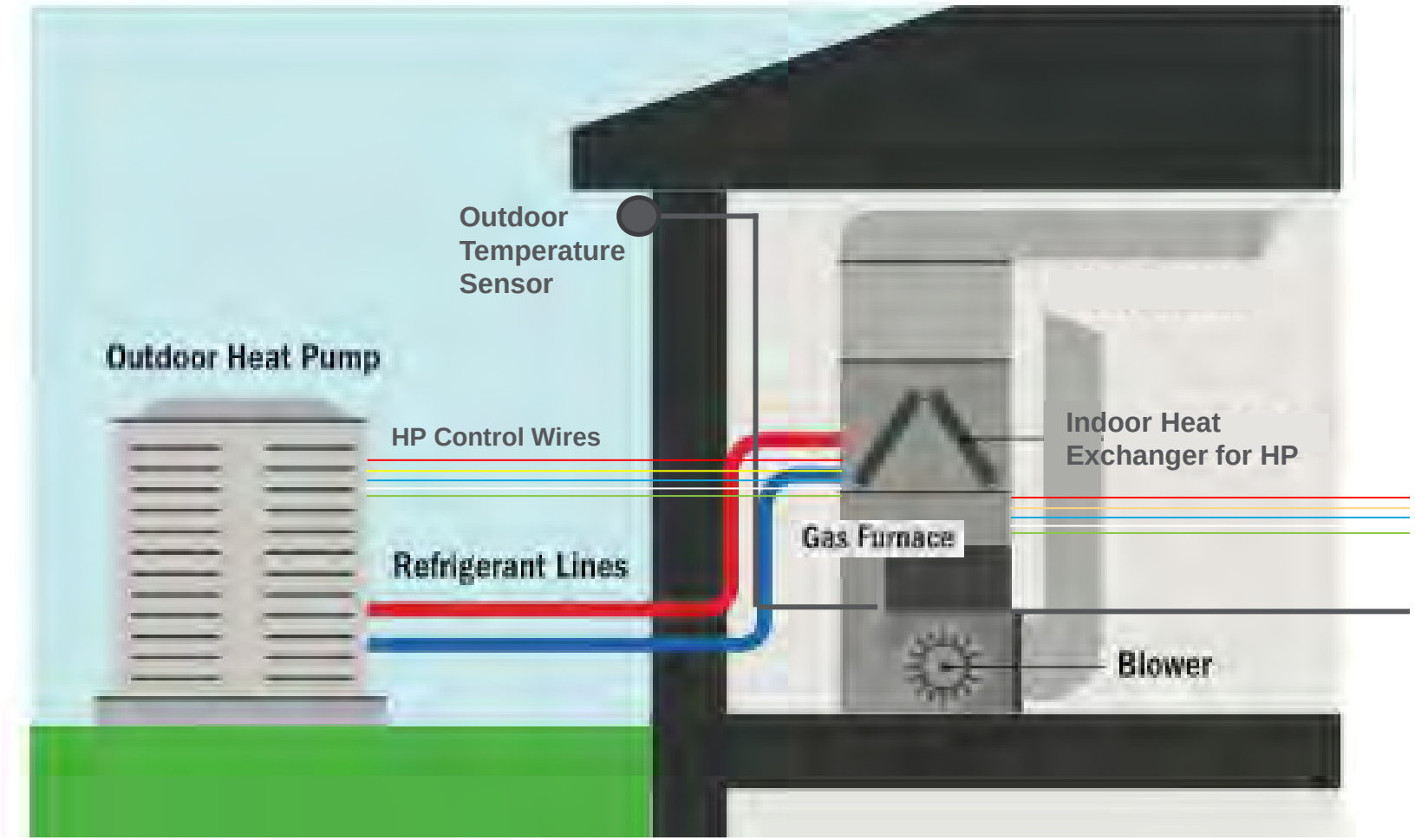
- Furnace is typically natural gas fueled, but can use a delivered fuel
- Operates during colder heating season temperatures;
- Furnace capacity is selected for the entire heating load of the home.

- Heat pump uses electricity for operations
- Operates during warmer heating season temperatures
- HP capacity is selected for the AC cooling load – **key design element**

- Controller selects furnace or HP as heating source
- It is wired to the furnace, the HP, and an outdoor temperature sensor

Dual Fuel Configuration

The controller is located conveniently in the home



- The outdoor temperature sensor reading drives fuel source decision.
- The controller is programmed by installer for an outdoor temperature “switchover”
- The controller opens and closes 24-volt circuits (analog) to achieve control.
- There are TWO essential installation elements here:
  1. Correct wiring
  2. Proper programming

2 Switchover Temperature Types

1. Thermal Balance Point
   - An analysis of the heating load calculation and the heating capacity “curve” of the heat pump
   - Installer selects the outdoor temperature ”point” at which the HP can no longer satisfy the heating load of the home.
   - Easier of the two balance points to calculate; doesn’t tend to change over time.
2. Economic Balance Point
   - An analysis of the heating load of the home, and the cost per BTU of the HP and the furnace. Usually requires software to calculate
   - For manufactured supplied configurations: Installer must know the costs of both fuels (electric and gas); these costs must be fixed. Otherwise, installer brain will explode.
   - More complicated and likely to change over time.

Residential buyers favor a single heating and cooling system that reduces their operating costs.

Cooling capability highly sought by residential buyers.

- Driven by the increasing number of warmer days in the Northwest.

Increased energy efficiency highly desired.

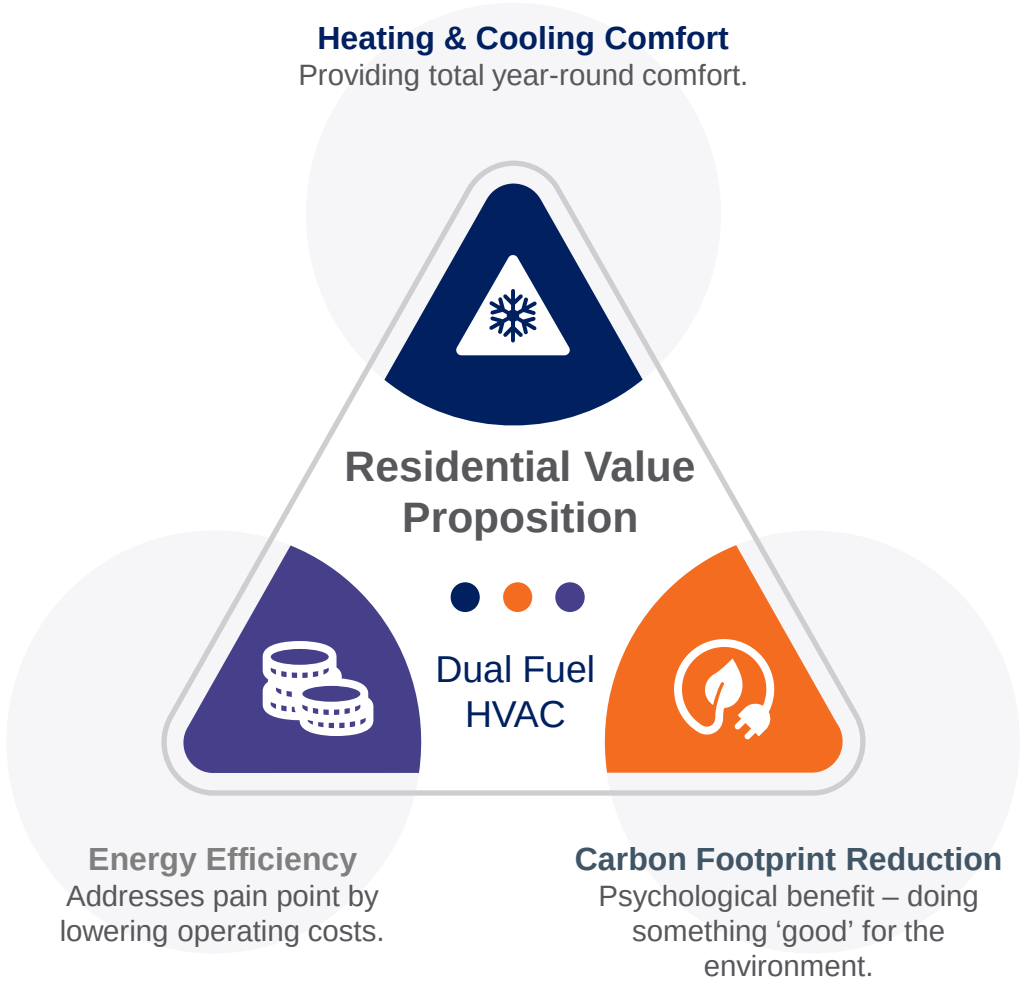
- Expectations are newer HVAC technology provides enhanced comfort (i.e.; quicker and more even heating/cooling), and increased fuel savings).

Carbon footprint reduction is a positive attribute.

- Considered a must by a minority and a highly desirable benefit of DFHP technology by the majority.

The value propositions for HVAC contractors are:

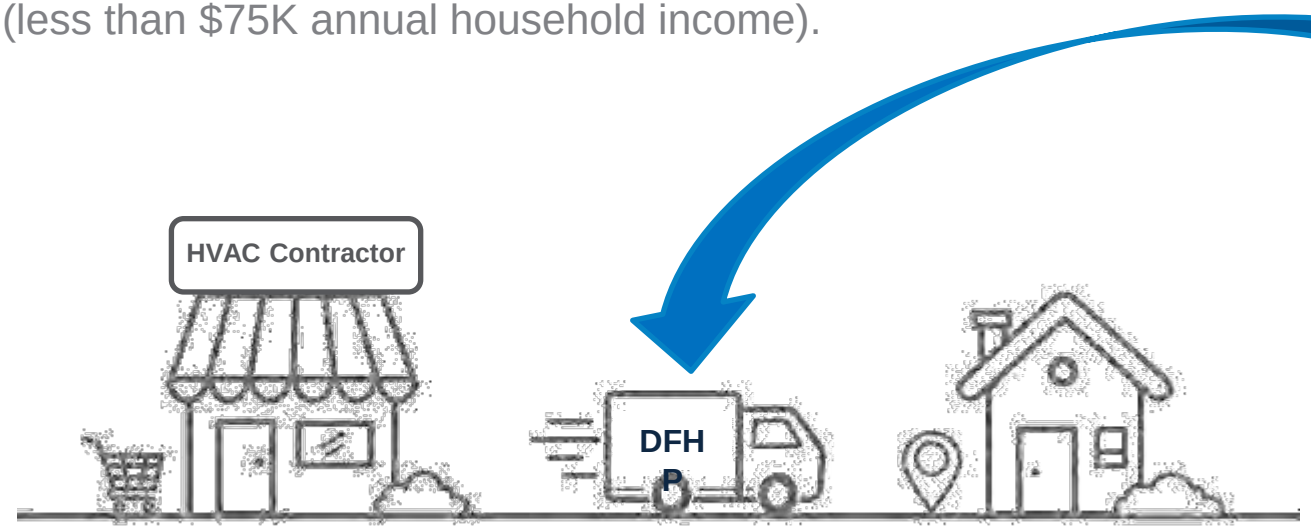
- No need for electric back-up heating installation – reduces cost and install time.
- Heating and cooling comfort energy efficiency for buyer meets the growing HVAC need of the Residential Buyer.
- No need for separate A/C unit – single system allows buyer to experience consistent temperature and lowers their expenditures.
- Can reduce carbon footprint – a selling point for contractors.



Current dual fuel heat pump sales driven by desire for a single space conditioning system, improved energy efficiency and carbon footprint reduction.

Current Drivers of Dual Fuel Heat Pumps

- Current residential Buyer DFHP awareness and interest being driven by HVAC contractors' recommendations, online research, or word-of-mouth recommendations from those they know. These buyers tend to be more proactive in seeking out information.
- These buyers are equally likely to be in urban and rural locations and are more likely to have annual household incomes in excess of $75K.
- Incentives in terms of rebates also appear to play a role, especially among those who are not financially well-off (less than $75K annual household income).



- **Ability to deliver even, year-round comfort (heating and cooling from a single system)**
- **Ability to deliver greater energy efficiencies**
- **Perceived to be better for the environment**

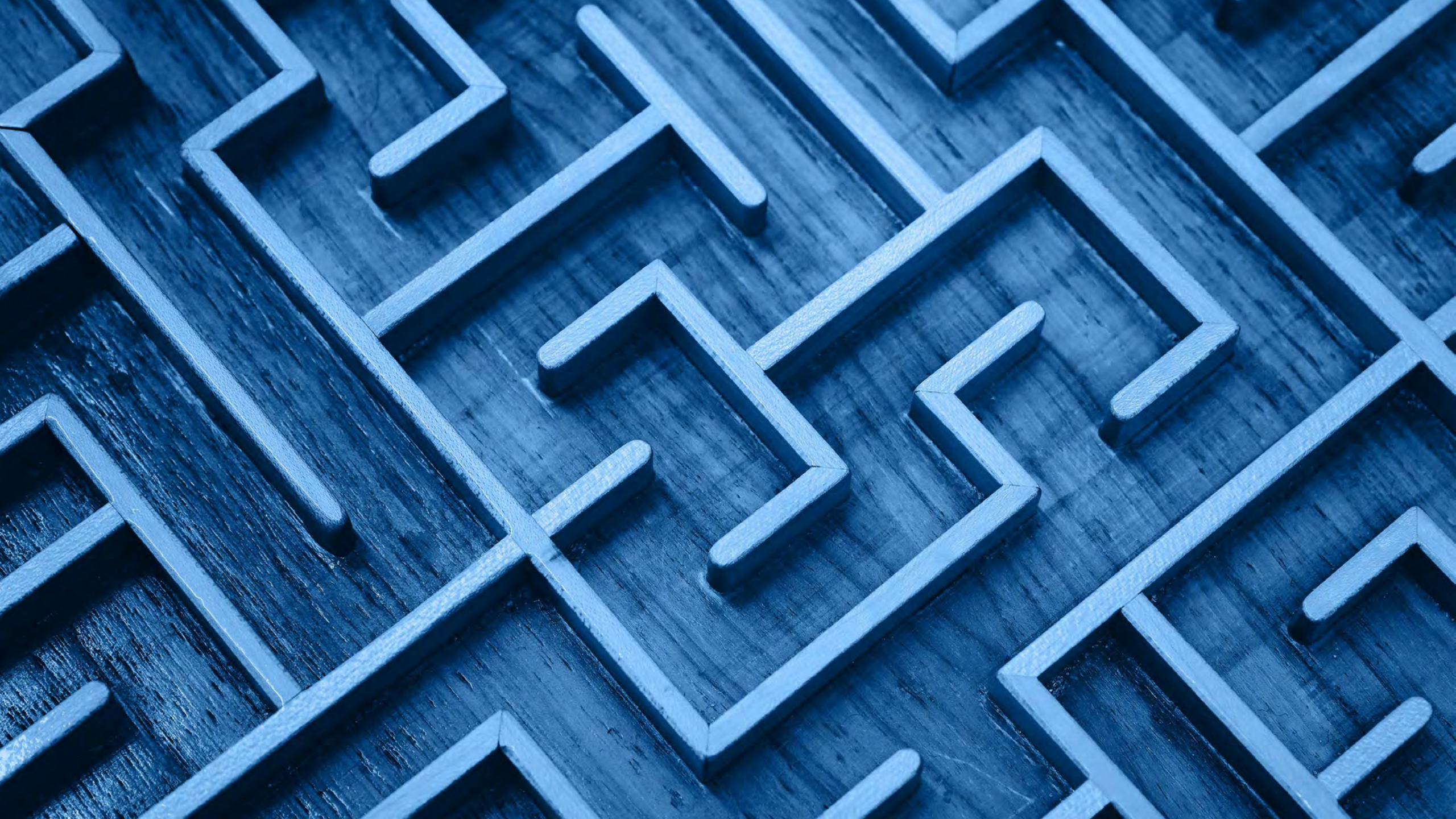
Northwest Code HVAC Updates

- There is a regional trend of state code updates resulting in increased HVAC efficiency in new buildings and major retrofits.
- In WA this is significant, while in other states we see a more subtle impact.

- Washington Gas Code
  - Prescriptive requirement
    - Electric HPs required (in most cases) (C403.1.4)
  - Fossil fuel allowance
    - < 5% of capacity or CFA (see Exception 8); ≤ 25% of load if supplemental to an air-to-water heat pump (see Exception 6)

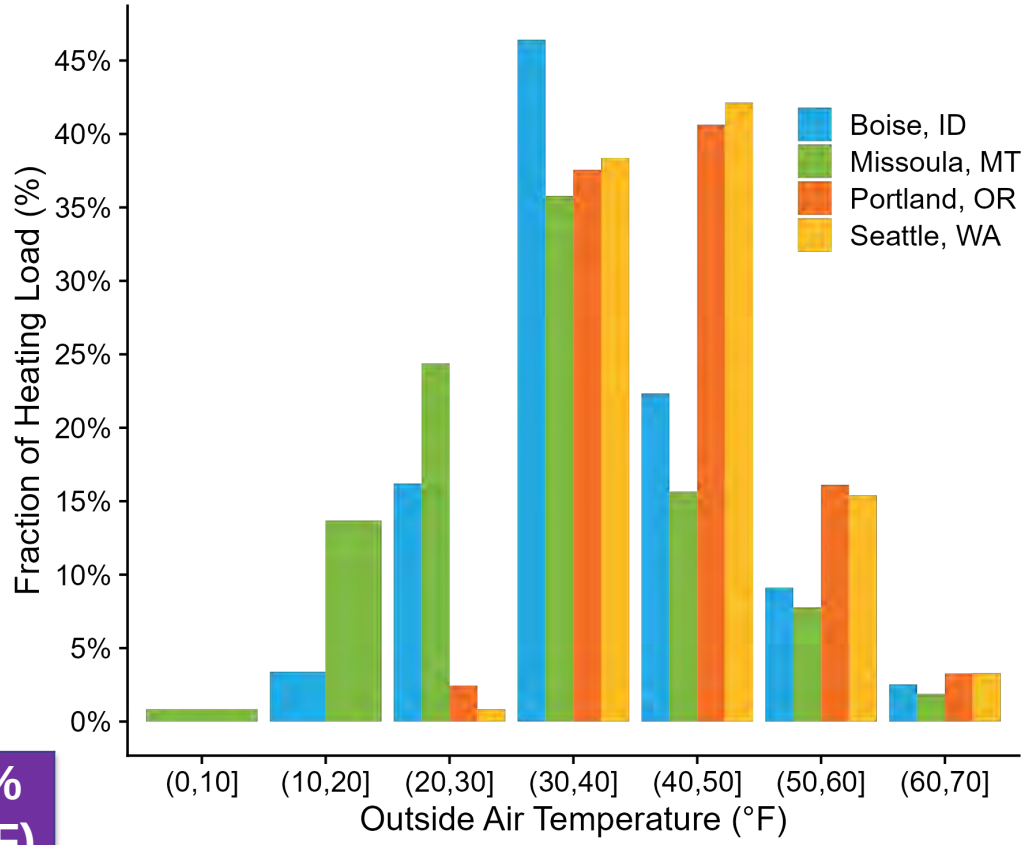
- 503.4.6 Addition or replacement of heating appliances. Where a mechanical heating appliance is added or replaced, the added or replaced appliance shall comply with Section C403.1.4 or with an alternate compliance option in Table C503.4.6.
- EXCEPTIONS:
  1. Terminal unit equipment including, but not limited to, hydronic VAV boxes, electric resistance VAV boxes, electric duct heaters, water source heat pumps, fan coils, or VRF indoor units that are served by an unaltered central system.
  2. Air handling equipment with hydronic coils.
  3. Air handling equipment designed for 100 percent outdoor air that is not subject to the requirements in Section C403.3.5 or that qualifies for an exception to Section C403.3.5.
  4. Replacement of existing oil-fired boilers.
  5. Replacement of existing steam boilers with steam distribution to terminal units and the associated boiler feed equipment.
  6. Where compliance with Section C403.1.4 would trigger an unplanned utility electrical service upgrade based on the NEC 220.87 method for determining existing loads.
  7. Like-for-like replacement of a single heating appliance is permitted where that appliance is failing, requires immediate replacement, and where no other HVAC work is planned.

NOTE: The above exceptions provide exemption from Section C403.1.4; thus, the use of electric resistance or fossil fuel combustion HVAC heating would be permitted where efficiency meets fed minimum/C403.3.2.



Large Regional Differences in Heating Load

- Portland and Seattle have negligible heating load below 30 °F
- Boise has 20% of the heating load below 30 °F, but mostly above 20 °F
- Missoula has 39% of the heating load below 30 °F, but mostly above 10 °F



Location	Climate Zone	HDD	99.6% DB (°F)	CDD	0.04% DB (°F)
Portland, OR	4C	5657	26	481	92
Seattle, WA	4C	5967	27	211	86
Boise, ID	5B	6099	11	**1234**	**99**
Missoula, MT	6B	**7964**	**-2**	547	93

Backup Usage Assumptions

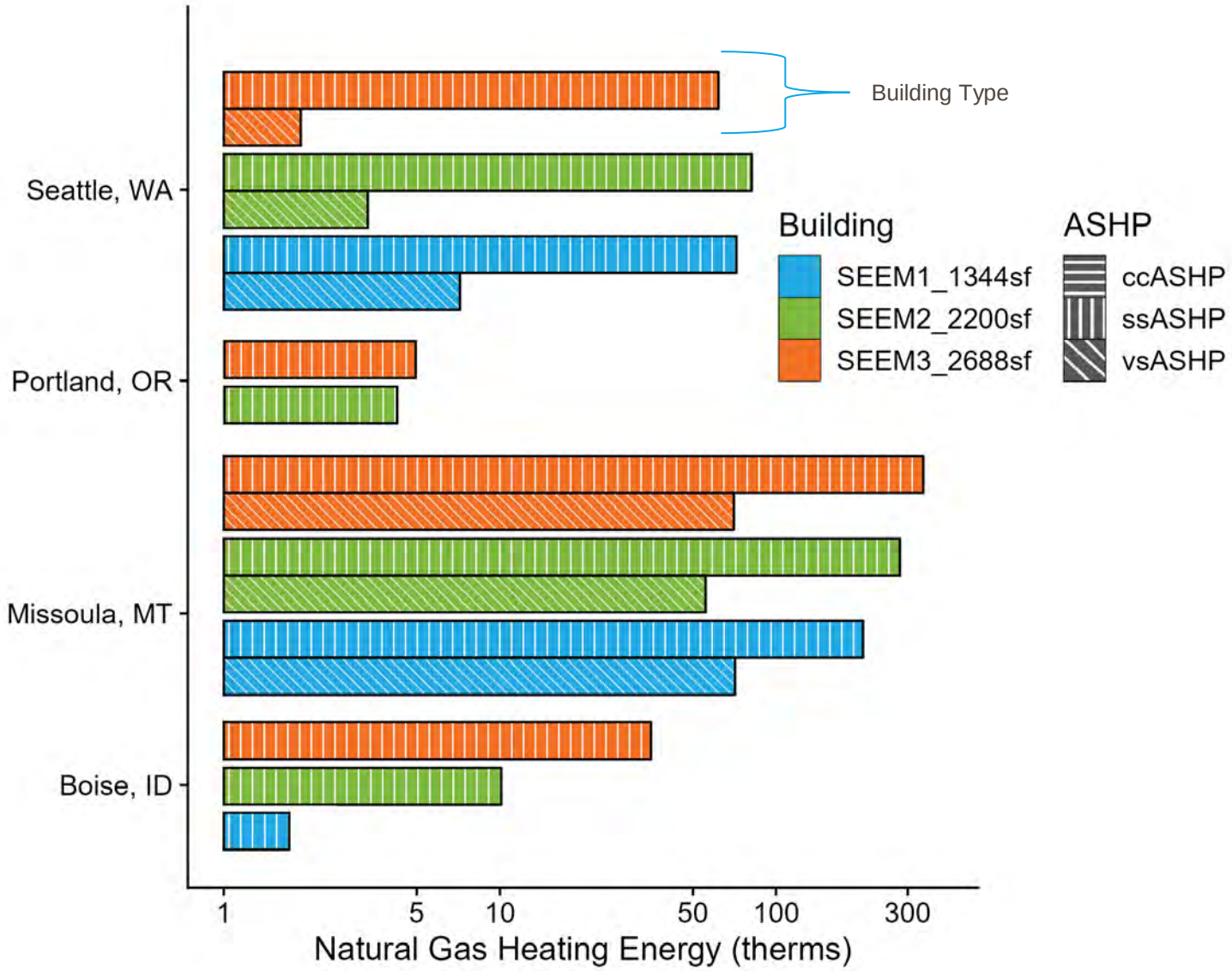
- The backup natural gas is used below the switchover temperature
- In all these energy results, this is the capacity switchover
- Maximizing heat pump may not be the most economic choice for the end user
- Model outputs are specific and very sensitive to assumptions

Backup Usage Assumptions

Climate	•TMY2020 weather for Seattle, WA; Portland, OR; Boise, ID; Missoula, MT
Building type	•SF_SEEM1 1344sf (slab on grade) UA 263 •SF_SEEM2 2200sf (crawl) UA 474 •SF_SEEM3 2688sf (basement) UA 610
ASHP Type	•Single speed ASHP (ssASHP) •Variable speed ASHP (vsASHP) •Cold climate variable speed ASHP (ccASHP)
Replacement type	•CAC only (keep furnace) •CAC + Furnace (full replacement)
Switchover temperature	•Temperature at which ASHP switches to backup furnace •Between 0 °F and 65 °F (regionally appropriate values)
Utility rates	•Electric rates varied from 0.08 to 0.12 $/kWh •Natural gas rates varied from 0.70 to 1.50 $/therm
Baseline HVAC	•Furnace AFUE 90% - 96% (regionally appropriate value) •SEER1 14.2 CAC

Backup Natural Gas Heating

- No backup heat needed for ccASHPs
- Negligible backup heat for vsASHP excluding Missoula (<10 therm)
- Negligible backup heat for ssASHP in Portland and smaller Boise homes (<10 therm)



[Product Council Presentation]

Hybrid (Dual fuel) Heat Pump Pilot

RETAC

June 27, 2023

EnergyTrust of Oregon

About us

Independent nonprofit

Serving 2.4 million customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista

Providing access to affordable energy

Generating homegrown, renewable power

Building a stronger Oregon and SW Washington

Our values

WE LISTEN

Everyone brings value and every idea brings opportunity. We need all perspectives to innovate and succeed.

WE CARE ABOUT EACH OTHER

Our teammates support and inspire. Together we'll build a better future.

WE MAKE A DIFFERENCE

Our work is important to people and the planet.

WE ARE CURIOUS

Asking questions and learning from experiences are key to our success.

WE WORK HARD TO FIND SOLUTIONS

We take action to remove barriers and advance new approaches.

WE ARE TRANSPARENT

Everyone benefits when we explain our work and report our results. Transparency builds trust.

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RENEWABLES

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Agenda

- What is Hybrid (dual fuel) HVAC (HHVAC)
- Research objectives
- High-level description of pilot design
  - Demographic focus, education and support
  - Home criteria
  - Pilot delivery, installation, quality assurance
  - Technical specifications
- Timing and utility/geographic scope
- Next steps

Hybrid (dual Fuel) HVAC (HHVAC)

Definition of Hybrid (dual fuel) HVAC

- For this pilot, Hybrid HVAC is a dual fuel system where a ducted single-speed heat pump and programmable thermostat are added to an existing gas furnace.
- The pilot application is in single-family homes without air conditioning and with gas furnaces that are five years old on average.
  - Homes have been previously weatherized
  - Homes do not have deferred maintenance that would prohibit successful installation or operation of HVAC system
  - Homes do not need major duct repair
  - Homes do not need major electrical service upgrades such as a new panel or braker box

Research Objectives

Research Objective 1

Determine the utility system costs and benefits of hybrid HVAC system installations.

- Fuel use – gas and electric
- Load/demand – gas and electric
- Carbon intensity – gas, electric and overall

Research Objective 2

Determine the customer costs and benefits of hybrid HVAC system installations.

- Energy costs – gas, electric and overall
- Added cooling value
- Comfort and living conditions
- Backup auxiliary-fuel
- Maintenance and upkeep

Research Objective 3

Determine the costs and process considerations associated with installing Hybrid HVAC systems in low-income households.

- Other necessary infrastructure changes – electric panels, ducts, etc.
- Homes served and homes disqualified
- Geographic regions served well and those we had difficulty serving – customer base size, installation contractors, supply chain
- Cost of installations – Hybrid HVAC system, other infrastructure, Energy Trust costs
- Timeline for installations – customer recruitment to successful implementation and use

Description of Pilot

Pilot Description

- Energy Trust to pay full cost of installs
- Income-qualified households, previously served by low-income weatherization services
- Homes must be weatherized and have a gas furnace no older than ~5 years, and no existing central AC
- House triage and customer education and support provided by Energy Trust staff
- Installation contractors selected through RFQ projects awarded on a rolling basis
- Post install QA provided by Energy Trust in every home

Heat Pump Specifications and Cost

- Heat pump size determined through Manual J, and cooling needs of the home (in alignment with ACCA2 Standard)

- Cross-over temperature
  - Energy Trust will leverage our installation Contractor RFQ to solicit more professional feedback on best practices
    - Goals - avoid customers experiencing no-heat conditions when heat pump switches to defrost mode
    - Follow manufacturer requirements depending on make/model
    - Stay within technical capabilities of equipment selection and controls

- Thermostat selection also to be explored through RFQ

- Cost range between $10,000 - $12,000 (not to exceed $13,000) per home

Customer Engagement & Support

Stage 1 – Phone Screening	Stage 2 – Virtual or In-Person Audit	Step 3 – Contractor site visit/bid creation	Step 4 – Contractor Installation	Step 5 – Ongoing Customer Support
• Income qualifications • Describe offer • Background on energy education/benefits of cooling • Risks around possible bill increases	• Performed by program team member • Verify thermal shell conditions • Assess existing gas furnace and ducts • Document electrical panel • Option: Connect with installer to collect data impacting bid	• Contractor visits home similar to traditional bid process • Checks to ensure project can be completed within CRP limitations	• Installer + electrician complete work at home • Program representative present on final day of installation to perform system QA & diagnostic testing. Also will provide customer education information	• Provide customer phone and email communication information for accessing Energy Trust • Complete post-installation survey(s) to verify satisfaction with system

Timeline

High Level Project Timeline

May 2023– June 2023

- Implementation planning
- Stakeholder engagement
- Measure development
- Installer recruitment

July 2023 – September 2023

- Customer recruitment
- Site eligibility verification

August 2023- July 2024

- Installations & site treatment
- Post-install verification & QA

July 2025– December 2025?

- Project Evaluation

Geographic Assumptions

- Prioritize overlapping gas and electric territories
- Concentrate efforts regionally to maximize delivery resources
- Leverage utility insights to support customer acquisition

Utility	Units
Pacific Power	20
PGE	20
NW Natural	26
Avista	12
Cascade Natural Gas	12
	90

Gas	Electric	Quantity	Geography
NWN	PGE	50	Portland Metro
AVI	PAC	20	S. Oregon / Klamath
CNG	PAC	20	Central / Eastern

Thank You

Energy Trust Pilot Team -

Tracy Scott, Steve Lacey, Thad Roth, Marshall Johnson, Andrew Shepard, Jackie Goss, Cody Kleinsmith, Julianne Thacher, Alex Novie

EnergyTrust of Oregon

PSE Hybrid Heat Pump Pilot

Jesse Durst, Senior Market Analyst (PSE)

June 27, 2023

PUGET SOUND ENERGY

About Puget Sound Energy

- **Headquarters:** Bellevue, WA
- Washington's largest and oldest utility, **serving 1.5 million customers** in 10 counties (Approximately 1.2 million electric and over 900,000 natural gas).
- Our **3,100+ employees** live and work in the communities we serve.

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Pilot Objectives and Overview

- PSE is exploring the value of Hybrid Heat Pump technology to Washington state and PSE-wide **decarbonization** goals
- Compare impacts of hybrid heat pumps to full **targeted electrification** strategies like cold climate heat pumps
- Identify level of **financial incentive** and **technical assistance** needed to encourage adoption of hybrid heat pumps
- Identify **software, equipment and control systems** to facilitate dual fuel/hybrid systems
- Learn about impacts of hybrid systems on **annual energy consumption** and **peak loads**.
- Learn about **customer** and **contractor** preferences and impressions regarding hybrid systems
- Learn about **risks** and **barriers** to adoption

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Eligible Equipment

Hybrid Heat Pump System Types

Split dual fuel systems

- Single or double- or multi-stage HPs combined with an existing or new natural gas furnace
- Can be set up with a variety of programmable or smart thermostats

Packaged dual fuel equipment

- May be more common in MH applications
- PSE does not expect much volume given the low number of MH with gas furnaces
- If you expect to install these, please contact our inbox (hybridheat@pse.com).

Inverter-based heat pumps compatible with new or existing furnaces

- Relatively limited models available
- Specialized controls required
- Daikin Fit or Mitsubishi Intelli-Heat

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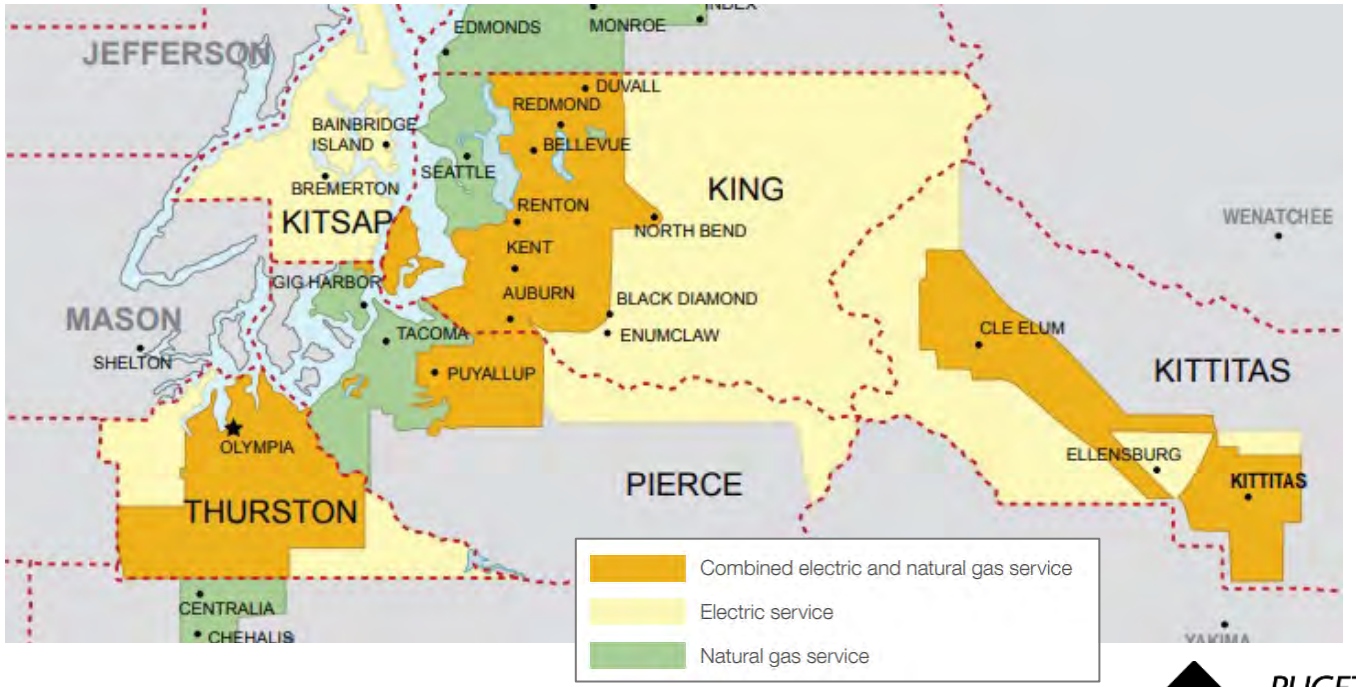
Pilot-Specific Participation Requirements

- Customer must have active gas **and** electric accounts
- Targeted at existing residential customers with natural gas forced-air furnaces as primary heat source
- Home with existing Air Source Heat Pumps are not eligible for this incentive (existing zonal DHPs are okay)
- Only approved contractors can participate and provide incentives to customers (no DIYs)
- PSE currently has a limited budget for up to 275 Hybrid Heat Pump systems; all systems must be installed by December 31, 2023



PSE PUGET SOUND ENERGY

Performance Specifications

PTCS ASHP Specifications

Hybrid HP Performance and Installation Requirements

- BPA PTCS Air Source Heat Pump Installation Specifications are considered a “best practice.”
- AHRI Certified® certified with a 9.0 HSPF or 7.7 HSPF2 or higher.
- Balance point must be 30 degrees F or lower.
- Auxiliary heat lockout must be 35 degrees F or lower.
- Consistent with WAC 51-11R-40310

System performance is critical to the success of the pilot

- PSE is attempting to displace as much gas usage as technically feasible to evaluate Hybrid HPs as a decarbonization measure
- This may sometimes conflict with overall system efficiency, competitive pricing and customer preference
- We are aware of practical issues such as defrost cycling, comfort, and ductwork issues when retrofitting existing customer systems

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2023 Hybrid Heat Pump System Incentives

Measure	Air Source Heat Pump	Natural Gas Furnace (Add-on)
Equipment Requirements	AHRI Certified® certified with a 9.0 HSPF or 7.7 HSPF2 or higher. If product has both HSPF and HSPF2 values, HSPF will be used to determine eligibility. Balance point must be 30 degrees F or lower. BPA PTCS Air Source Heat Pump Installation Specifications are considered a "best practice."	AHRI Certified or ENERGY STAR qualified with 95% AFUE rating or better. Auxiliary heat lockout must be 35 degrees F or lower.
Rebate	**$1,700** for SF / MH	**$700** for SF / MH
Customer Requirements	PSE natural gas **and** electric customer	PSE natural gas **and** electric customer
Additional Requirements	Customer's existing primary heat source must be a natural gas furnace. No existing ASHPs may be present. ASHP must be installed with a new or existing natural gas furnace. Integrated system controls are required. DHPs generally will not qualify.	Customers are only eligible for the furnace incentive as an "add-on" to the ASHP incentive if they are replacing their existing furnace when installing the heat pump.

Total maximum downstream system incentive is $2,400, *but incentives are stackable with PSE Midstream incentives (if qualified)*

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Evaluation, Measurement and Verification (EM&V)

- Participant survey
  - Survey serves to capture basic household characteristics
  - Pre-existing HVAC thermostat type and settings (if available)
  - Installed heating and cooling setpoints
- Contractor survey
  - Will serve to capture satisfaction levels and views on the program pilot
- HVAC equipment sub-metering
  - After installation, select customers will be invited to participate in an energy metering study
  - Monitor indoor and outdoor HVAC equipment current draw and air temperatures

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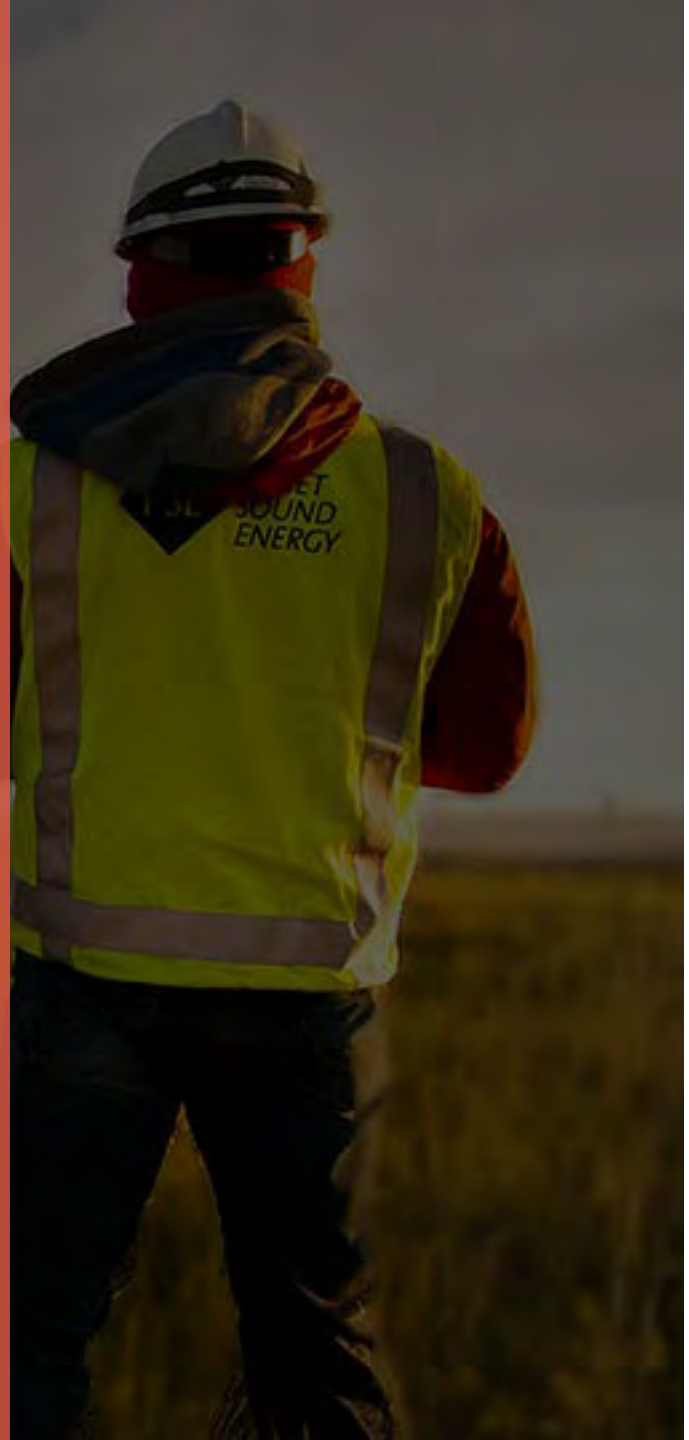
Timeline



May 24 – Trade Ally Training; bids may begin

June 1 – Go live/Launch pilot; installations may begin

December 31 – Final projects installed

January 31, 2024 – Final applications submitted

Targeted Electrification Pilot

Megan Lacy, Program Manager (PSE)

June 27, 2023

PSE PUGET SOUND ENERGY

Pilot Objectives

- 40% efforts conducted in Named Communities
- Educational Theme

- **Home Electrification Assessments**
  - 10,000 assessments, PSE gas & dual fuel customers
  - $50 gift card incentive + referral incentives
  - Road map to electric lifestyle

- **Heat Pump Rebates**
  - $2,400 - $4,000 rebates
  - Tax credit eligible
  - PSE dual fuel customers
  - Must remove natural gas furnace

- **Special Projects**
  - 50 LIW + HP installs
  - Multifamily Project
  - 3 Small Business Makeovers

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CLOSING

- ***Public Comments/Q&A***
- ***Poll Questions***

How did we do this quarter?

1. What's one thing you appreciated about this meeting?
2. What would you like to see at a future meeting?
3. What's got you curious right now in the realm of energy efficiency?

If the poll didn't work for you, please let us know in the chat box what the problem was: if you used the app or browser, and the error message you got, if any.

Thank You!!