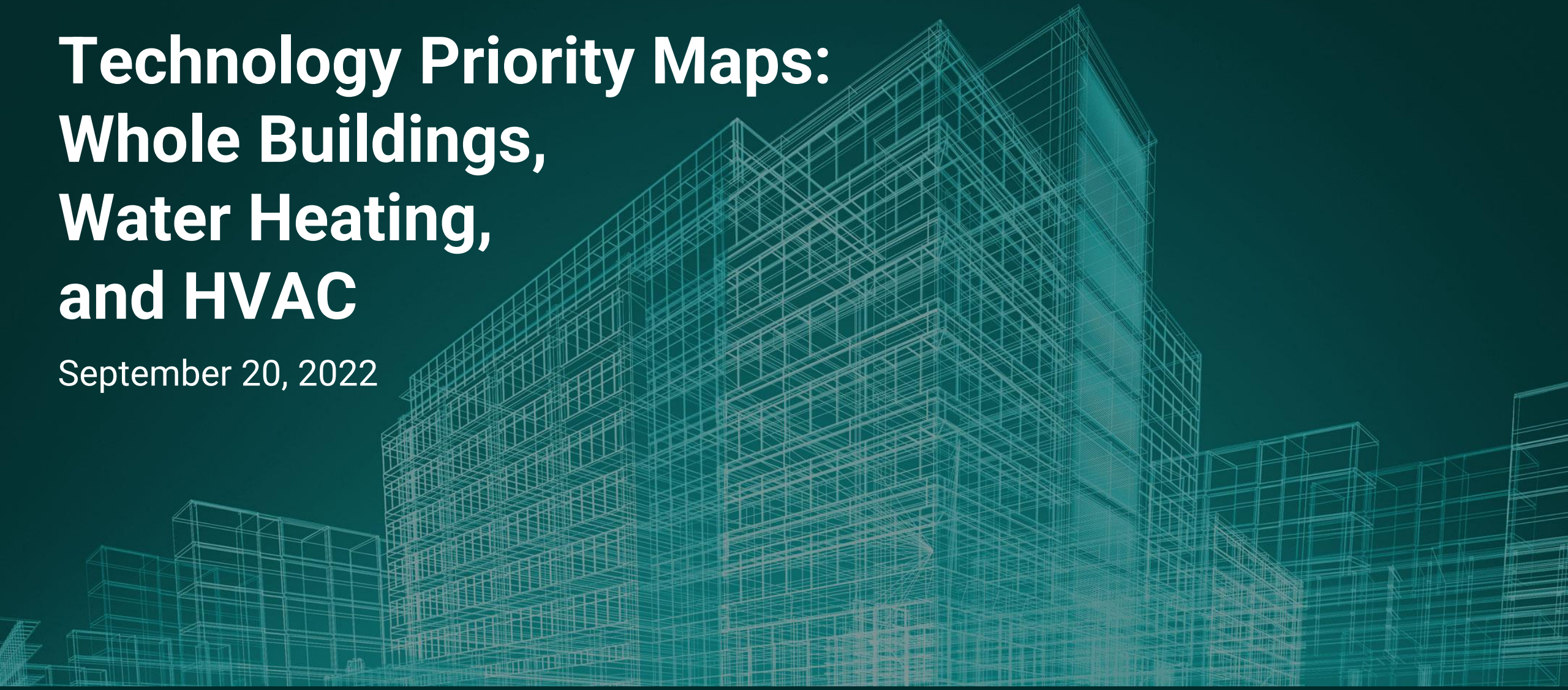
Technology Priority Maps: Whole Buildings, Water Heating, and HVAC

September 20, 2022



CalNEXT
ENERGIZING CALIFORNIA'S FUTURE

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Presenters

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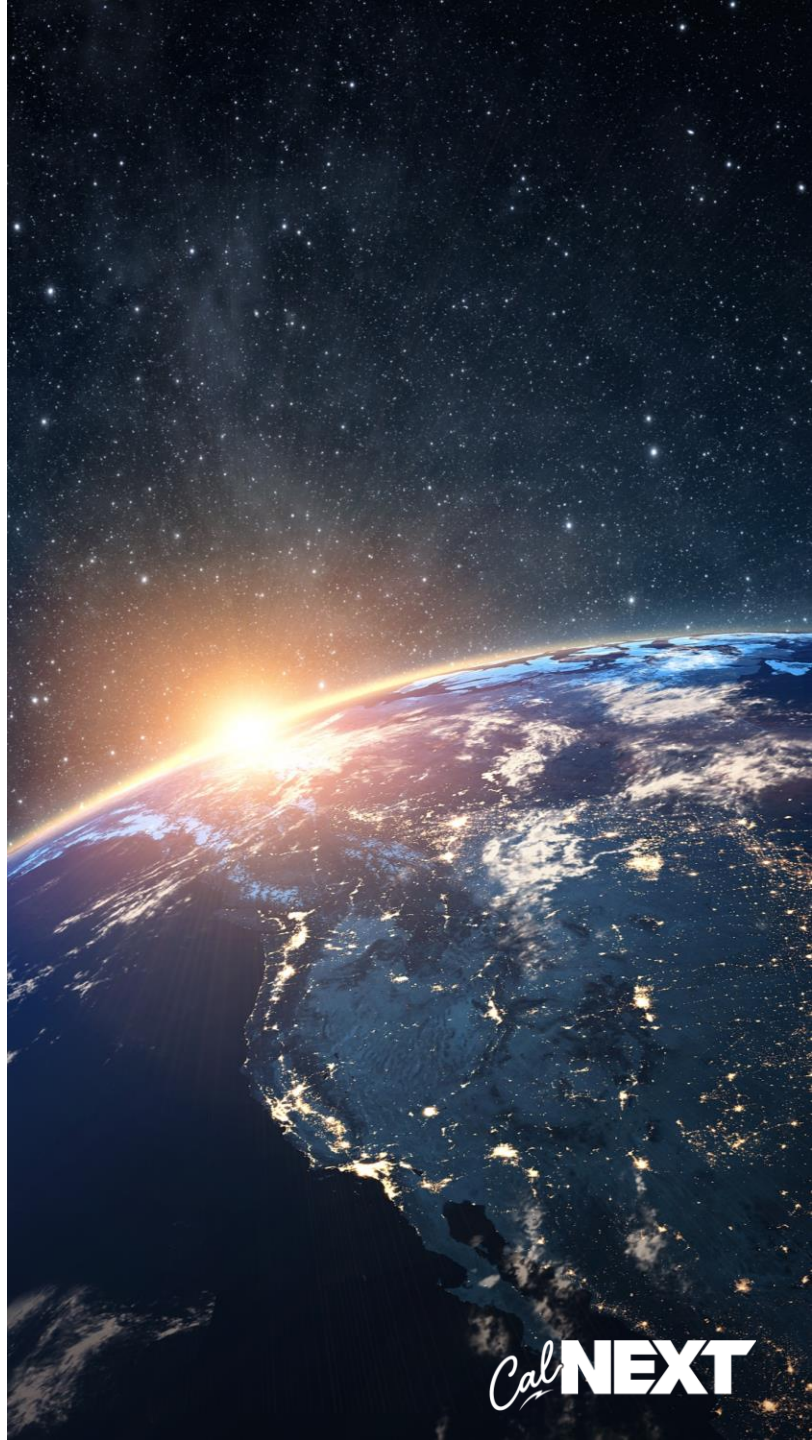
Agenda

1	Introduction to CalNEXT & TPMs
2	Intro to Whole Buildings TPM
3	Intro to Water Heating TPM
4	Intro to HVAC TPM
5	How to Participate
6	Feedback/Q&A


Introduction to CalNEXT & TPMs
CalNEXT

About CalNEXT

CalNEXT's vision is to identify emerging technology trends and bring commercially available technologies to the energy efficiency program portfolio.



Program Objectives

- **Communicate** program priorities to stakeholder community.
- **Scan, Prioritize, Evaluate** commercially available, emerging, or underutilized technologies and their applications to support increased adoption in the IOU EE portfolios.
- **Broadcast** results to inform stakeholders, support technology transfer, and advance industry understanding to support large-scale commercial adoption.
- **Advance** California's decarbonization, equity, and grid priorities by incorporating them into research priorities.
- **Execute** emerging technology research projects that support the IOU energy efficiency portfolios.

IOU Portfolios

Workpaper Development

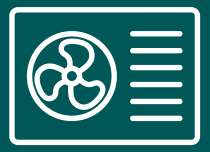
Program Integration

C&S Readiness

Market Transformation

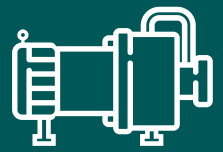
What are the TPMs?

Appliances & Plug Loads



HVAC

Lighting



Process Loads

Water Heating

Whole Buildings

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 research topics we want to fund.

Internal Tool for Screening
25% of score is based on alignment with TPMs

TPMs – Glossary

- **Technology Category:** One of Six Broad Categories (Whole Buildings, HVAC, Water Heating, etc.)
- **Technology Family:** Functional grouping that describes program role, opportunities, barriers
- **Subgroups / Example Technologies:** Common examples for each family
- **Definitions:** Narrative to provide additional clarity on the technology family scope
- **Opportunities:** Description of the potential impacts and focus areas within a TPM
- **Barriers:** Description of key barriers and potential barriers research within a TPM

2022 TPMs: Major Changes

Updated for recent policy changes

The 2022 TPMs incorporates several recent policy developments identified in the CEC's 2021 IEPR including new emphases on equity, embodied carbon of cement (SB-596), flexible demand technologies (SB-49), and CPUC's Total System Benefit (D 21-05-031 R. 13-11-005)

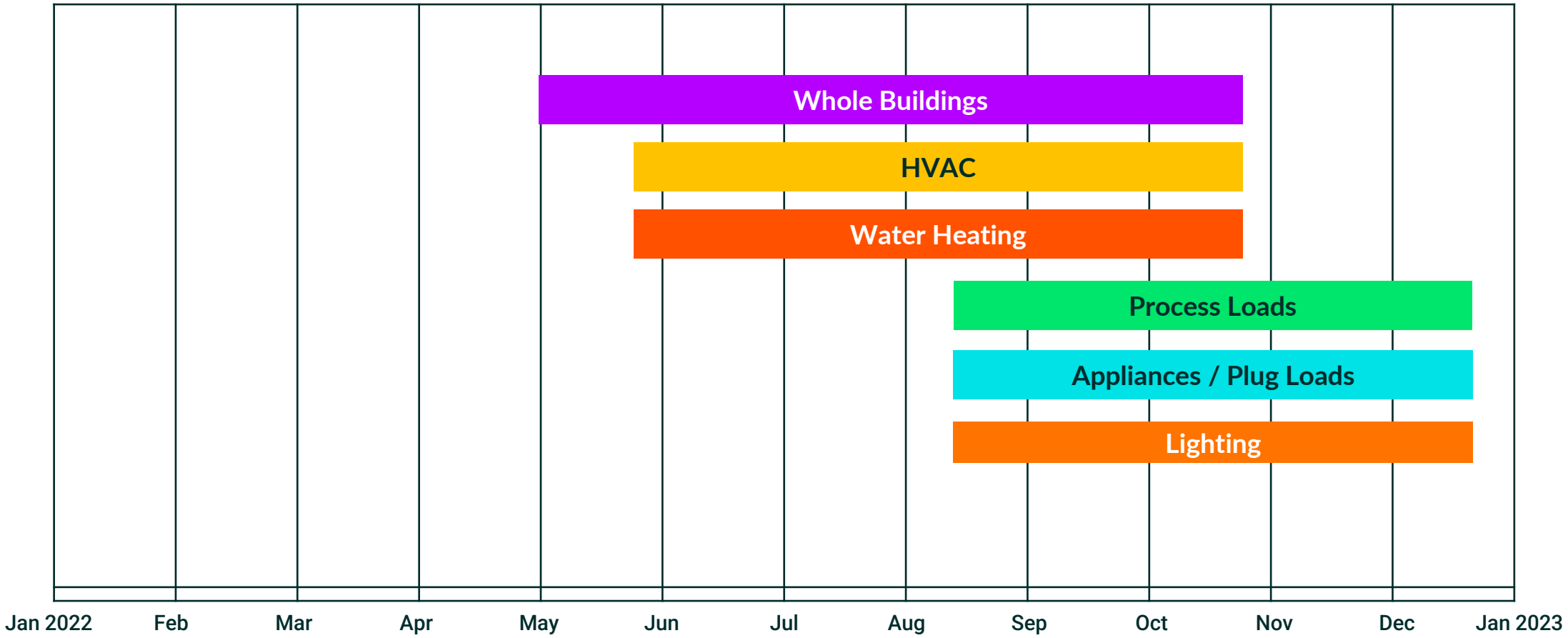
Reorganized Technology Families

Technology Families have been reorganized to better differentiate new priorities and program emphasis.

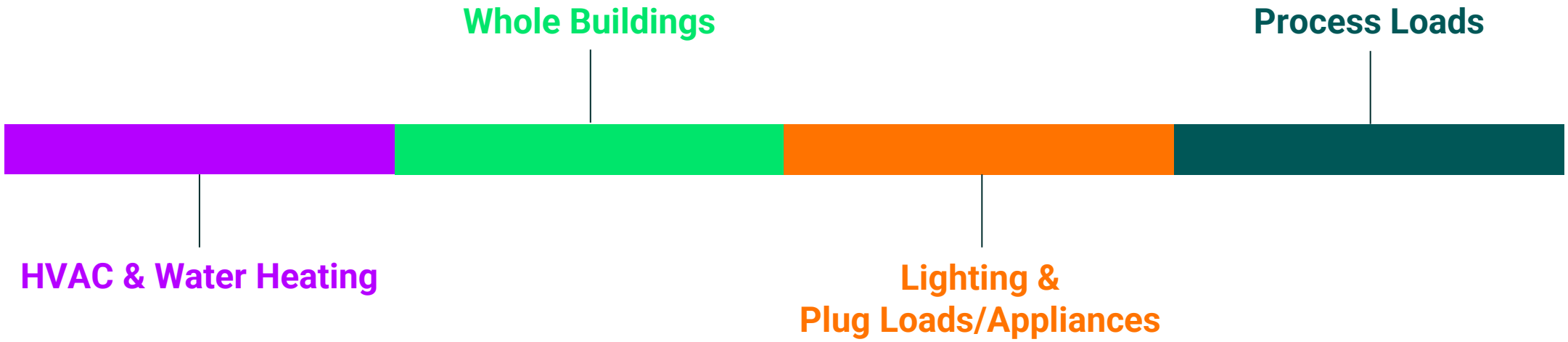
Emphasis on "actionable" projects

Under the 2022 version of the TPMs we are highlighting the "Barriers" and "Opportunities" sections of the TPM to provide transparency on what we'd like to see researched & developed for CalNEXT.

TPMs - 2022 Update Schedule



TPMs – 2023 Update Process



Poll #1

Who is joining us today?

Please respond to the Zoom poll

Whole Buildings

Opportunities and Barriers

- Significant structural changes made from the previous 2020 TPM Whole Buildings TPM. New TPM is focused on building systems rather than market sectors.
- New opportunities identified in embodied carbon emissions reductions targeted at the design, construction, and manufacturing industries.
- Electrical Infrastructure takes center stage for decarbonization.

Technology Family Summary

- High Priority:
  - Integrated Systems
  - Whole Building Design & Construction
  - Electrical Infrastructure

High Priority Areas – Integrated Systems

SUBGROUP / Example Technologies	DEFINITIONS

• Multifunction Equipment
• Integrated Controls
• Integrated/Interactive Measure Packages
 	
• Examples include:
  • Heat Pump serving Hot Water and Space Heating
  • Networked Lighting sensors used for lighting and HVAC occupancy controls
  • Electrification measure packages (Envelope improvements & Heat Pump Retrofit)
	Components, systems, or controls with integrated approaches that work across multiple TPM Technology Categories.

High Priority Areas – Design & Construction

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Manufactured Housing • Modular Building Components • Panelized Components • Low-Embodied Carbon designs • Site-built design • High-Performance Building Design	This Design & Construction Technology Family is focused on changes to the design or manufacturing of structures to reduce emissions, costs, and energy use. This includes techniques to reduce embodied carbon emissions in building materials as well as the use of partial or whole off-site construction such as manufactured housing, or panelized construction.

High Priority Areas – Electrical Infrastructure

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Electric Panel Upgrades • Transformers • DC-Power Systems	Innovations in the electrical infrastructure needs and capabilities to enable low- or carbon-neutral buildings, demand-flexible end-uses, distributed energy resources, and grid harmonization.

Water Heating

Opportunities and Barriers

- The transition of both residential and commercial water heating from natural gas to electric heat pump will lead a vast decarbonization of this end-use, and intelligent controls and load-shifting strategies are essential to create the demand flexibility needed to avoid grid constraints.
- Commercial-duty heat pump water heaters require development of both product offerings and technical design tools that may optimize sizing and added features such as drain heat recovery, recirculation, and mixing.
- New tariff structures and grid integration programs are needed to mitigate cost-effectiveness concerns around water heater controls and encourage participation in demand flexibility efforts.

High Priority Areas

- Residential-duty Water Heaters
- Commercial-duty Water Heaters

High Priority Areas – Residential-duty Water Heaters

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Unitary and Split-System heat pump water heaters • Low-GWP refrigerants	Product-focused research on efficient, demand-flexible, electric water heating products designed to meet the hot water demands of residential households or buildings with similar water heating needs.

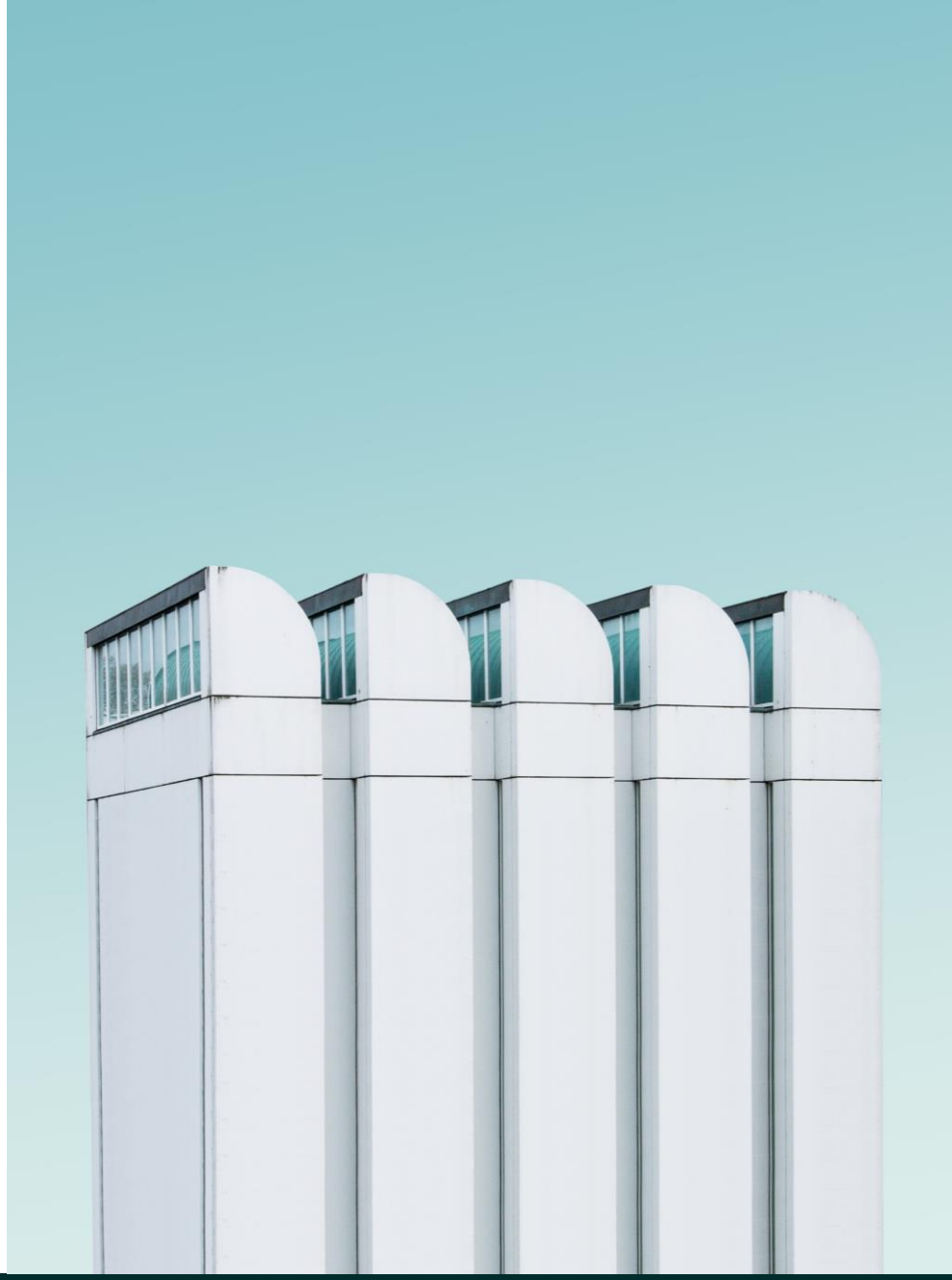
High Priority Areas – Commercial-duty Water Heaters

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Central heat pump water heater systems for multifamily, hotel/motel, food service, pools and commercial buildings • Dual-fuel water heaters • Low-GWP refrigerants	Product-focused research on efficient, demand-flexible electric water heating systems for commercial applications (offices, pools, and food service) and multi-family residential (typically ≥5 dwelling units) applications.

HVAC

Opportunities and Barriers

- CalNEXT expects a two-path approach within HVAC. For matured products such as high efficiency air-to-air packaged heat pumps, we expect to focus on market deployment. For less developed product markets like air-to-water heat pumps, CalNEXT expects continued field demonstrations and early-stage research.
- CalNEXT also anticipates significant activity to inform utility programs and standards efforts as they adapt to new appliance standards for central air conditioners & heat pumps and unitary air conditioners & heat pumps which will see new standards, test procedures, and metrics in 2023 as well as new low-Global Warming Potential (GWP) requirements driven by CARB.



High Priority Areas

- 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

High Priority Areas – High Efficiency Heat Pumps for Space Heating and Cooling

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Air-to-water Heat Pumps for space heating • Air-to-air Heat Pumps for Space Heating and Cooling • Variable Refrigerant Flow Systems (VRF) • Split System Packaged Heat Pump	Compressor-based packaged equipment that can provide efficient heating (and potentially cooling). “High- efficiency” equipment typically contains variable speed (VS) fans, compressors, and/or pumps. Additional pathways to high efficiency performance include advanced heat exchangers and advanced controls algorithms.

High Priority Areas – Scalable HVAC Controls Deployment

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Building Automation Systems (BAS) • Automated Fault Detection Diagnostics (FDD), • Advanced Monitoring and Data Analytics • Grid-adaptive Controls • Load Management Controls • Smart Thermostats (Residential)	Advancement of sensors, controllers, and demonstrations of new control strategies that improve the performance of a building's HVAC energy use and component functionality with an emphasis on scalability and deployment of control systems.

High Priority Areas – Hybrid or Fully Compressor-less HVAC

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS

• Evaporative and indirect evaporative cooling
• Non-Compressor systems such as:
  • Desiccant-based
  • Absorption
  • Thermoacoustic
  • Thermoelectric
  • Radiant heat rejection
	HVAC cooling and heating systems that use alternatives to vapor compression cycles or hybrid combinations of alternatives along with vapor compression cycles.
	While evaporative cooling represents the most mature and developed of these, this family also includes emerging technologies such as desiccant systems, absorption, adsorption, thermoacoustic, thermoelectric, magnetocaloric, and others.

High Priority Areas – Heat Pump Market Transformation

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Program designs • deployment strategies • financing mechanisms • other market transformation research	Innovative program designs and supporting research to accelerate deployment and overall market transformation of the California heat pump market. May include financing innovations, turn-key incentive design, or other coordination with various market actors.

High Priority Areas – HVAC Design for Decarbonization

SUBGROUP / EXAMPLE TECHNOLOGIES	DEFINITIONS
• Decoupled HVAC Systems • Heat Recovery Chillers • Other Whole System All-Electric Designs	A holistic HVAC design that is aimed at achieving a high efficiency, low emissions system in both new and existing buildings.

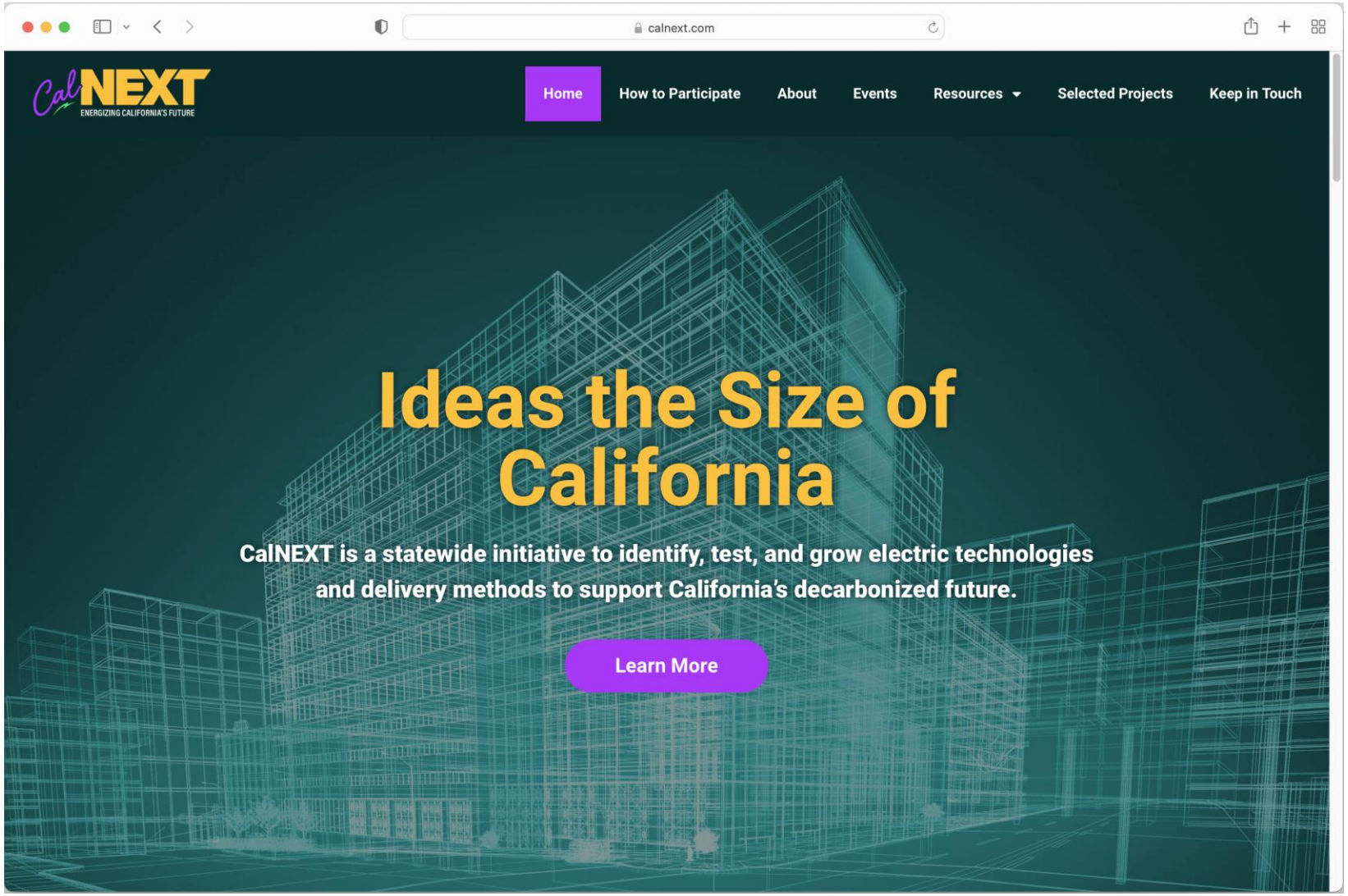
Poll #2

For which TPM are you interested in submitting a project?

Please respond to the Zoom poll

How to Participate

CalNEXT.com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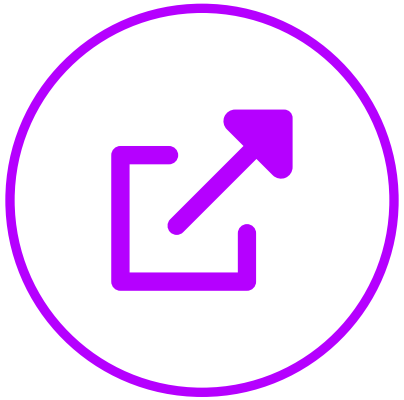
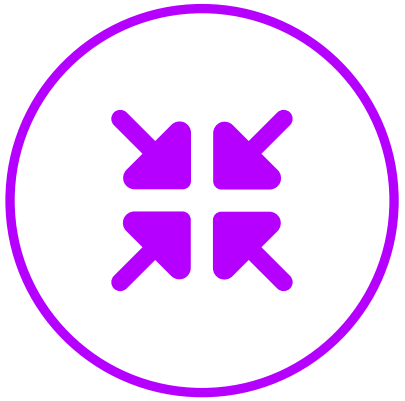
Project Types



Technology Support Research

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



Technology Development Research

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

Project Submission

Submit an Idea

Submit a Project

Submission Process

Prioritization Framework

Criteria	Weighting	Details
TPM Alignment	25%	How well the project aligns with the CalNEXT TPMs
Benefits	20%	Whether the project has benefits for the utilities and affects HTR/DACs
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

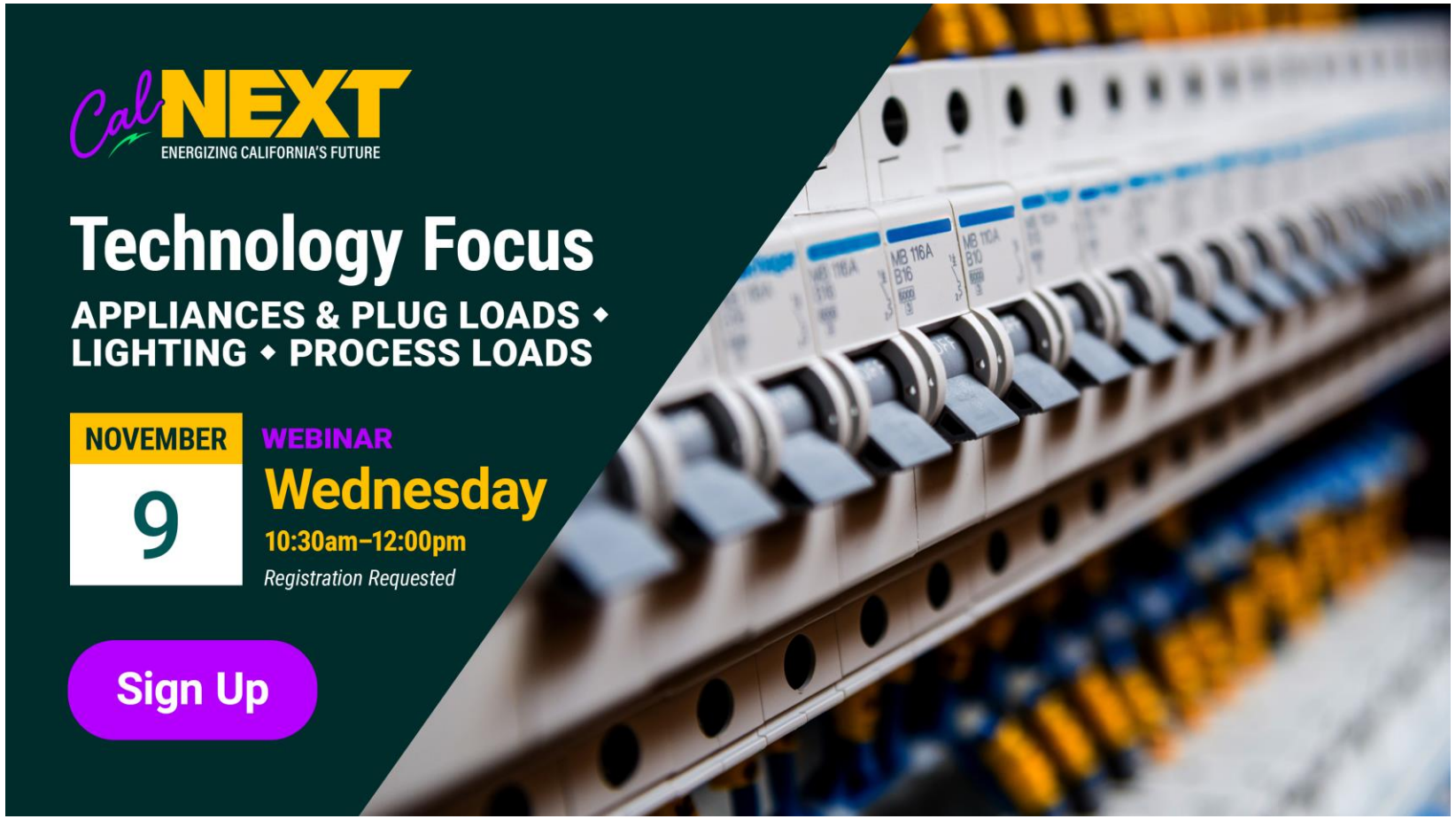
Poll #3

How close is your product to commercialization?

Please respond to the poll

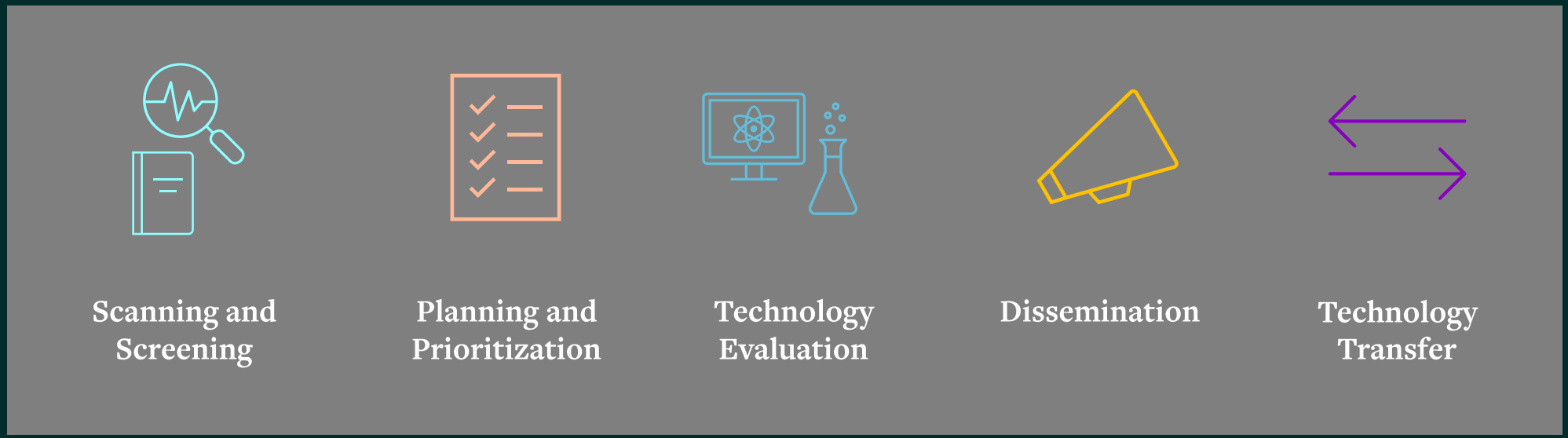
Feedback/Q&A

Upcoming Event



CA Statewide Gas Emerging Technology

The Statewide Gas Emerging Technologies Program (GET) advances promising as potential measures for future energy-efficient programs. Working with cross functional stakeholders, the GET program sources and screens technologies at a TRL of 4 and higher to gather necessary technical and savings potential data, identify key market barriers to adoption, and develop strategies to overcome these barriers.



For more info: https://cagastech.com

Thank You!

David Myers **Tim Minezaki**

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