Scanning and Screening — Q4 2023

Final Report

ET23SWE0052

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Executive Summary

The CalNEXT Program utilizes the Scanning and Screening process to engage with energy efficiency market stakeholders, solicit research project ideas, and develop a robust project portfolio for electric emerging technology projects. The two Project types that are evaluated within the Scanning and Screening process are the Technology Development Research (TDR) and Technology Support Research (TSR) projects.

The Quarter 4 (Q4) 2023 Scanning and Screening Project covers the period from October 1, 2023, through December 15, 2023. The Project submissions for this period came from the program team (Energy Solutions and the five subcontractors – AESC, TRC, UC Davis, Ortiz Group, and VEIC) and from the public via the Idea or Project Intake Form. To guide the selection of projects, the CalNEXT program team utilizes the 2022 Technology Priority Maps (TPMs) for all technology areas other than Plug Loads and Appliances and HVAC. For the latter technology areas, the program team uses the TPMs published on July 1, 2023.

Scanning and Screening Activities Completed in Q4 2023

- Completed two rounds each of Scanning and Screening and Fast Track Project Review.
- Received 43 project submissions and evaluated 23 Project submissions. The other 18 were received at the very end of the quarter and will be evaluated in Q1 2024.
- The program team evaluated, scored, and analyzed results for project submittals, with four to six evaluators per project.

Scanning and Screening Q4 2023 Summary of Results

- Project submissions represent five of the six TPM Technology Areas including 10 in HVAC, 8 in Water Heating, 8 in Process Load, 11 in Whole Building, and 6 in Plug Load and Appliances
- Project submissions are split between 7 program tactics, including 2 behavioral studies, 14 field demonstrations, 5 lab demonstrations, 5 market characterization studies, 12 measure developments, 1 scaled field deployment, and 3 tool developments.
- Evaluation scores among partner submissions ranged from 53 to 85.
- Out of the 43 Project Submissions received this quarter, 17 were public submissions and 26 were partner submissions. Many of the public submissions were received at the end of November and will be scored in February 2024
- 5 projects were selected through the Fast Track process based on input from CalTF and SCE.

Key Recommendations

- Continue to engage program implementers to inform technology transfer opportunities in the program portfolio.
- Assess remaining submissions and statuses of 2024 Committed Projects to prepare for 2024.
- Evaluate Scanning and Screening process feedback from partners and public submitters and consider process refinement as appropriate.

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Abbreviations and Acronyms

Acronym	Meaning
AESAP	Agricultural Energy Savings Action Plan
AHU	Air Handling Unit
AI	Artificial Intelligence
AMI	Advanced Metering Infrastructure
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASU	Arizona State University
BMS	Building Management System
BPA	Bonneville Power Administration
Cal TF	California Technical Forum
CBE	Center for the Built Environment
CBO	Community-Based Organizations
CCA	Community Choice Aggregation
CCx	Continuous Commissioning
Cx	Commissioning
CEC	California Energy Commission
CO_2	Carbon Dioxide
CPUC	California Public Utilities Commission
CZs	Climate Zones
DAC	Disadvantaged Communities
DEER	Database for Energy Efficient Resources
DOE	United States Department of Energy
DR	Demand Response
DSM	Demand Side Management
EE	Energy Efficiency
EEM	Energy Efficiency Measures
EM&V	Evaluation, Measurement, and Verification
EPA	United States Environmental Protection Agency
EPRI	Electric Power Research Institute
ET	Emerging Technology
ETP	Emerging Technologies Program

Acronym	Meaning
EUL	Emergency Use Listing
FPIP	Food Processing Incentive Program
GHG	Greenhouse Gas
GWP	Global Warming Potential
HP	Heat Pump
HTR	Hard-to-Reach
HUD	United States Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IAQ	Indoor Air Quality
IOU	Investor-Owned Utility
ISP	Internet Service Provider
KSU	Kansas State University
kWh	Kilowatt-hour
LI	Low-Income
M&V	Measurement and Verification
MAT	Measure Application Types
MBCx	Monitoring Based Commissioning
MIDAS	Market Informed Demand Automation Server
MMH	Mobile and Manufactured Homes
NBI	National Buildings Institute
NC	New Construction
NEEA	Northwest Energy Efficiency Alliance
NMEC	Normalized Metered Energy Consumption
NYSERDA	New York State Energy Research and Development Authority
PA	Program Administrator
PAWS	Partnership for Advanced Window Solutions
PCM	Phase Change Material
PG&E	Pacific Gas & Electric
PM	Particulate Matter
POWER	Panel Optimization Work & Electrical Reassessments
PNNL	Pacific Northwest National Laboratory
QC	Quality Control

Acronym	Meaning
RCx	Retrocommissioning
REN	Regional Energy Network
RFI	Request for Ideas
RTU	Rooftop Unit
SaaS	Software as a Service
SB	Senate Bill
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SGIP	Self-Generation Incentive Program
SMUD	Sacramento Municipal Utility District
SPUR	San Francisco Bay Area Planning and Urban Research Association
SWEEP	State Water Efficiency and Enhancement Program
TDR	Technology Development Research
TES	Thermal Energy Storage
TPM	Technology Priority Map
TSR	Technology Development Research
UV	Ultraviolet
VAV	Variable Air Volume
VOC	Volatile Organic Chemicals
VRF	Variable Refrigerant Flow
WH	Water Heating
ZERH MH	Zero Energy Ready Home - Manufactured Housing

Introduction

The CalNEXT Program uses a Scanning and Screening process which leverages the existing Technology Priority Maps (TPMs).[1] The process engages with the market ecosystem to solicit ideas for developing a robust project pipeline for electric emerging technology (ET) projects. The two types of projects that are evaluated within the Scanning and Screening process are Technology Development Research (TDR) projects and Technology Support Research (TSR) projects. The approach includes broad outreach to a wide range of stakeholders with structured guidance about the Program and encourages a wide range of high-quality idea submissions aligned with the utility energy efficiency (EE) portfolios' needs and statewide energy goals. The process includes communicating Program priorities, processing applications, and maintaining scoring criteria to support and encourage broad participation in the program. The scope of the Scanning and Screening project in Q4 2023 includes all existing TPM technology areas and projects that fall under the TDR or TSR categories. Project submissions are expected from the program team as well as the public.

In Q4 of 2023, the CalNEXT Program received three rounds of project submissions. The first round of project submissions came from public submitters and resubmissions from partners, the second round of submissions came from partner submitters, and the final round comprised of public submissions and resubmissions both public and partner. This final round of submissions will be evaluated next quarter. With each submission round, the evaluation team prioritized projects to add to the program's portfolio that meet 2023 and 2024 targets and maintain portfolio balance in terms of technology areas and research types.

Background

When designing the CalNEXT Scanning and Screening process, the program team consulted staff from other ET programs outside of California via telephone and conducted a literature review of materials from Efficiency Vermont, Wisconsin Focus on Energy, Bonneville Power Administration (BPA), Northwest Energy Efficiency Alliance (NEEA), and New York State Energy Research and Development Authority (NYSERDA). Stakeholders including staff from Southern California Edison (SCE) and California Public Utilities Commission (CPUC) were also engaged during the original development of the Scanning and Screening process via meetings and through implementation plan review.

Prior to the program launch in 2022, Energy Solutions and VEIC finalized the Scanning and Screening process flows and program templates such as the Prioritization Framework Matrix and Idea Intake Form. The team also selected Wrike to become the project management platform and developed the project scoring guidance and instructions. The Scanning and Screening process uses Wrike to collect Project and Idea submissions and ensure there is adequate information for scoring.

[1] Both the 2022 (Lighting, Process Loads, HVAC, and Whole Building) and 2023 TPMs (Plug Loads and Appliances and HVAC as of September 1, 2023) highlight CalNEXT's research priorities across 6 technology categories and 46 technology families. Source: https://calnext.com/resources/#tpm

The program began accepting project submissions from program partners in April 2022 and from the public in July 2022, and then established a continuous improvement approach to fine tune the submission and evaluation process.

Now upon the close of the program's second year, the program team has made numerous process improvements, including the addition of scoring calibration and portfolio planning meetings. The Fast Track process was also incorporated into the Scanning and Screening process to expedite ideas that address immediate portfolio needs. Regarding submitter communication, the CalNEXT team has made improvements to responses provided to submitters whose projects or ideas were deferred. Past submitters found communication around this topic confusing at best and unsatisfactory at worst. The new language better differentiates the "deferred" status from the "discontinued" status for the submitter.

Objectives

The main objective for the Q4 Scanning and Screening Project was to administer successful project selection rounds from both partner and public participants.

Of the project submissions collected throughout Q4 2023, the team aims for a project selection rate of at least 35 percent to be added to the CalNEXT project portfolio based on the number of submissions received thus far. The evaluation team continues to maintain a fair and transparent scoring process while ensuring it follows Project Plan objectives.

Methodology & Approach

The CalNEXT program team's methodology is to recruit and guide potential project leads to submit project ideas; conduct reviews to validate that project ideas meet CalNEXT eligibility requirements; evaluate complete submissions against the Program Prioritization Framework criteria, calculate scores; convene evaluators to confirm project selections; and communicate to all project submitters results and next steps.

The Q4 2023 Scanning and Screening project has leveraged the 2022 TPMs (and, as of September 1st, the 2023 HVAC and Plug Load TPMs) to solicit ideas for ET projects, which are available on the CalNEXT website. Project submissions are expected from the program team as well as the public. Program team staff have been collaborating with external stakeholders and are active participants in previous California ET programs.

The program team called for program partners to submit their projects for consideration in the first month of the quarter, called for the public to submit their projects for consideration in the second month of the quarter, and will collect all resubmittals from both partner and public submitters in the third month of the quarter. This tripartite split of submissions allows for the program to provide adequate support for submitters between the staggered submission deadlines. Eligible project submissions are evaluated using the Prioritization Framework Matrix for consistent structure to rank and score projects, which can be found in Appendix A. Appendix B includes a detailed description of the evaluation process. CalNEXT's method for screening and evaluating submissions includes

involving a variety of subject matter experts from all the partner organizations with differing focuses and strengths to obtain a diverse collection of perspectives. Scoring review meetings are held after each round of scoring to discuss projects receiving low scores and/or a high standard deviation among scores, understand differing scores amongst evaluators, and collectively come to a decision regarding the future of a project idea. Scoring review meetings also help clarify any discrepancies found where the score doesn't align with the evaluator's recommendation. If a potential bias is discovered, VEIC will review the feedback to determine next steps for the project final scores and project selection, with guidance from Energy Solutions as needed. In Q4, there were no biases determined that have changed the final scoring and selection.

The program team will engage stakeholders throughout each quarter to ensure feedback from previous rounds of Scanning and Screening is implemented. Once project submissions are selected, project leads will submit pre-draft project plans for internal review and Energy Solutions will submit them to SCE for review, feedback, and acceptance.

Lastly, the Fast Track process exists as an additional avenue for partners (or IOUs via partners) to submit and expedite ideas based on program priority. These submissions are not evaluated through the standard scoring process but are evaluated based on the same criteria. The Fast Track process can be found in Appendix C. If submissions meet these criteria, the project evaluation leads hold an ad-hoc Scanning and Screening review meeting to vote on whether each Fast Track submission will move forward to the Project Planning stage. The meetings being ad-hoc in nature rather than regularly scheduled allow for expedited adoption of Fast Track projects into the program, which is beneficial to meeting program goals.

In Q4 2023, several efforts were made to engage stakeholders, increase program awareness, and solicit adequate submissions. In addition to regular quarterly recruitment activities and outreach, the program team issued a Request for Ideas (RFI) to encourage the submittal of projects falling into technology and utility program areas that have low project submission rates. The RFI was shared on the program website, social media, and listserv. Additionally, the program team hosted a webinar on November 6, 2023, to promote the RFI and answer any follow up questions.

Below is a list of events that occurred during Q4 in relation to both public and partner submissions.

- October 25, 2023: Posted notice of RFI webinar on CalNEXT website.
- October 27, 2023: Posted notice of RFI webinar on CalNEXT website.
- October 30, 2023: CalNEXT subscribers received communication on the Q4 RFI webinar.
- October 31, 2023: A social media post announced the Q4 RFI webinar.
- November 3, 2023: CalNEXT subscribers received a reminder about the Q4 RFI webinar.
- November 16, 2023: Attendees were sent a thank you email with follow-up information.
- November 28, 2023: Posted reminder regarding the deadline for Q4 submissions.
- Weekly reminders of upcoming Scanning and Screening dates are provided to program partners along with informative dashboards powered by Wrike Analyze.

In September 2023 there was a 2024 Portfolio Planning Working Session where the program team reviewed the current state of the program portfolio, reviewed all deferred idea and project submissions, and brainstormed portfolio needs for 2024. The results of this meeting will support Scanning and Screening activities in Q4 2023 and into 2024.

The Preliminary Findings Report is developed midway through the quarter once partner submissions have been received and scored. The Draft and Final Reports document findings and results from all rounds of project and idea submissions and include recommendations. The Distribution Report summarizes the dissemination of the Final Report.

Results

Results from Q4 2023 cover the scores of the partner submission round, Fast Track submissions, as well as re-submissions received in Q3 and scored at the beginning of Q4. Ten public submissions were scored at the beginning of the quarter, and 15 project submissions were received and scored from the program team (Energy Solutions and the five subcontractors— Alternative Energy Systems Consulting, Inc. (AESC); TRC Companies, Inc. (TRC); The University of California, Davis (UC Davis); The Ortiz Group; and VEIC) and scored in early August.

The highest achievable score is 100, with 10 possible points from the HTR/DAC benefit criteria. The HTR/DAC benefit score is determined by The Ortiz Group, the Program partner who specializes in DACs. While the project scores listed in the table below include the HTR/DAC scores, they are also listed separately to note potential HTR/DAC impact according to each project. The next steps of the project are a combination of the recommended next steps chosen by evaluators on the project scorecards as well as discussions and votes that took place at the Scanning and Screening review meeting. Full scoring details for all project submissions are included in Appendix D through Appendix BB.

Partner Submissions Overview

- One partner submission was a re-submission.
- 15 projects were submitted by the October 26 partner submission deadline.
- All 15 project submissions were scored in early November, and final selections were made following the Scoring review meeting on November 16.

Of the 15 Q4 submissions scored, six were approved to move forward by the Program Leadership team (or their delegates). All project leads have been notified and have begun work to submit their pre-draft plans to SCE for review and acceptance. Following evaluators' scoring, it was determined that seven projects would be asked to edit and resubmit by the December 28th resubmission deadline. One project was deferred. One of the projects was scored and evaluated and was set to be discussed during the Scoring Review Meeting, but due to a compressed preparation schedule and a scheduling difficulty with the presenter, discussion and final decision for this project will take place during January's Scanning and Screening round. The scoring details for these 15 projects, as well as full project descriptions, are included in the Project Evaluation Summaries in Appendix D through Appendix BB.

Table 1 includes information about the partner project submissions, including TPM alignment, Project type, research type, and intended timeframe.

Table 1: Q4 Partner Project Submission Characterizations

Project Name	TPM	Project Type	Research Type	Program Development Support
DAC HTR Statewide SF Housing Characteristics Study	Whole building	TSR	Market characterization/study	Support existing measure
Laboratory Evaluation of Residential Smart Panels	Whole building	TSR	Lab demonstration	Support new/updated custom measure
Medical Devices Market Characterization Study	Plug load and appliances	TSR	Market characterization/study	Support new/updated workpaper development
Performance Evaluation of DC EVSE	Plug load and appliances	TSR	Lab demonstration	Support new/updated custom measure
Small Medium business HPWH emergency deployments	Water heating	TSR	Field demonstration	Technology program support
Commercial Kitchen Heat Pump Assisted Water Heater Field Demonstration	Water heating	TSR	Field demonstration	Support new/updated custom measure
New CFS Measure Prioritization	Process loads (commercial, industrial, agriculture, water)	TSR	Tool development/enhancement	Technology program support
Commercial Ultra-Low GWP Heat Pump Field Demonstration	Heating ventilation air conditioning (HVAC)	TSR	Field demonstration	Technology program support

Project Name	TPM	Project Type	Research Type	Program Development Support
Multi-purpose Hydronic CO2 Heat Pump for Commercial Buildings	Heating ventilation air conditioning (HVAC)	TSR	Measure development enhancement	Support new/updated custom measure
Total System Benefit (TSB) Market Research: TSB Implications for EE programs and emerging technologies	Whole building	TSR	Market characterization/study	Support existing measure
Field demonstration of electric clothes dryer controller	Plug load and appliances	TSR	Field demonstration	Support new/updated workpaper development
Efficient Elevators Market Characterization Study	Process loads (commercial, industrial, agriculture, water)	TSR	Market characterization/study	Support new/updated workpaper development
Wastewater Energy Transfer Technology Feasibility Study	Water heating	TSR	Market characterization/study	Technology program support
Advancing Whole Building Measurement Methods	Whole building	TDR	Tool development/enhancement	Support existing measure
HVAC Thermal Energy Storage System for VAV boxes	Plug load and appliances	TDR	Field demonstration	Support new/updated custom measure

Table 2 lists each project's overall score, specific hard-to-reach (HTR)/disadvantaged community (DAC) benefit score, and the project's next steps determined by evaluators.

Table 2: Q4 Partner Submissions Scoring Results

Project Title	Overall Score	HTR/DAC Score	Project Next Step
DAC HTR Statewide SF Housing Characteristics Study	79	6	Selected
Laboratory Evaluation of Residential Smart Panels	79	0	Selected
Medical Devices Market Characterization Study	74	3	Selected
Performance Evaluation of DC EVSE	69	0	Selected
Small Medium business HPWH emergency deployments	69	3	Selected
Commercial Kitchen Heat Pump Assisted Water Heater Field Demonstration	69	0	Will be evaluated in Q1 2024
New CFS Measure Prioritization	68	0	Edit and Resubmit
Commercial Ultra-Low GWP Heat Pump Field Demonstration	66	0	Selected
Multi-purpose Hydronic CO2 Heat Pump for Commercial Buildings	63	0	Edit and Resubmit
Total System Benefit (TSB) Market Research: TSB Implications for EE programs and emerging technologies	62	3	Edit and Resubmit
Field demonstration of electric clothes dryer controller	61	2	Edit and Resubmit

Project Title	Overall Score	HTR/DAC Score	Project Next Step
Efficient Elevators Market Characterization Study	59	0	Edit and Resubmit
Wastewater Energy Transfer Technology Feasibility Study	58	3	Edit and Resubmit
Advancing Whole Building Measurement Methods	55	3	Deferred
HVAC Thermal Energy Storage System for VAV boxes	55	6	Edit and Resubmit

In Q4 2023, there were seven Fast Track ideas submitted, and two review meetings took place on November 2 and November 16. In the first meeting three projects were evaluated resulting in two approvals and one asked to submit as a traditional project. In the second meeting, four ideas were evaluated with three receiving approvals to proceed with their pre-draft plans and one being asked to submit as a traditional project. Details about those projects are included in Table 3.

Table 3: Q4 Fast Track Projects

Project Name	TPM	Project Type	Research Type	Timeframe	Decision
Commercial High Efficiency Windows Measure Package Completion	Whole Building	TSR	Tool Development/Enhancement	9 months	Approved
Residential High Efficiency Windows Measure Package Completion	Whole Building	TSR	Tool Development/Enhancement	6 months	Approved

Project Name	TPM	Project Type	Research Type	Timeframe	Decision
High-Performance Laboratory Refrigerators and Freezers Measure Development	Process Loads	TSR	Measure Development/Enhancement	6 months	Submit as a Traditional Project
Large Ultra-Low Temperature Freezer Measure Offering	Process Loads	TSR	Measure Development/Enhancement	9 Months	Approved
Plug-in HPWH Measure Package Updates to eTRM	Water Heating	TSR	Measure Development/Enhancement	12 Months	Approved
Light Commercial Variable Speed Heat Pump Performance Map	HVAC	TSR	Measure Development/Enhancement	9 Months	Approved
Insulation in Commercial Buildings (Wall Attic and Roof Insulation)	Whole Building	TSR	Measure Development/Enhancement	12 Months	Submit as a Traditional Project

Public Submissions Overview

Ten public submissions submitted during Q3 were scored in early October. Scorecards were sent to evaluators on October 5, and they completed their review by October 11. VEIC compiled and summarized the scores and feedback for the projects. Final Decisions were made after the Scoring Review Meeting on October 19.

Of the ten Q4 submissions scored, four were approved to move forward by the Program Leadership team (or their delegates). All submitters have been notified and have begun work to submit their pre-draft plans to SCE for review and acceptance. After the evaluations, it was determined that five

projects would be asked to edit and resubmit by the December 28th resubmission deadline. One project was discontinued.

The full scoring details for the public submission, including the project's overall score, specific hard-to-reach (HTR)/disadvantaged community (DAC) benefit score, and the project's next steps determined by evaluators is included in Table 4.

Table 4: Q4 Public Submissions Scoring Results

Project Title	Overall Score	HTR/DAC Score	Project Next Step
Advancing Natural Refrigerant Based Heat Pumps for All Electric Commercial Heating and Cooling in California	62	3	Edit and Resubmit
Characterization of Central Heat Pump Water Heating Deployment in the Multifamily Market	79	0	Approve
Demonstration of "Combi" Air-to-Water Heat Pump	85	10	Approve with Edits
Electrifying Large Commercial + Thermal Storage: Demonstration of TIER and Program Delivery Implications	83	0	Approve
Enabling Non-Residential Electrification and Efficiency with Fault Managed Power Systems (FMPS)	78	6	Approve with Edits
Harvesting Mid-size Industrial BRO Savings	72	5	Edit and Resubmit
NZE Buildings as Grid Stabilizers	69	4	Discontinue
Overall Emissions within Manufactured Housing	58	3	Edit and Resubmit
Thermal Energy Storage for Refrigeration	53	2	Edit and Resubmit

Project Title	Overall Score	HTR/DAC Score	Project Next Step
Transpiration Only Irrigation	62	5	Edit and Resubmit

16 public submissions were submitted by the November 30 deadline. 12 of these submissions will be scored in January. Three of these submissions were paired with partners to be resubmitted by the December 28 resubmission deadline. One of these submissions was discontinued.

Deferred Submissions

In Q4, the program deferred 2 submissions, bringing the total number of deferred projects to five. No review was conducted of deferred projects this quarter, but there is potential for one or more of them to make an appearance in 2024's portfolio considerations. In 2024 the program team may consider deferred projects to fill portfolio needs as appropriate.

Table 5: Q4 Deferred Projects

Project Title	Tech Area	Research Type	Date of Deferral	Reason
Advancing Whole Building Measurement Methods	Whole Building	Tool Development	11/16/2023	Pertains more to DR than EE
Brewery Heat Pump Demonstration Project	Water Heating	Field Demonstration	10/4/2023	Overlap with existing project
Dynamic Model Predictive Control for Building Energy Management	HVAC	Scaled Field Deployment	4/13/2023	High cost
eTemp Food Simulating Sensor Medium for Commercial Refrigeration	Plug Load and Appliances	Measure Development	3/27/2023	Submitter could not lead project alone
Propane Monoblock	Process Loads	Scaled Field Deployment	2/28/2023	Overlap with Existing Project

Analysis of Portfolio Results

The Q4 Scanning and Screening Project administered successful project submission rounds among both public and partner participants. 20 total projects were submitted by both partner and public submitters, with six moving on to be scored. Two projects have been approved and added to the CalNEXT project portfolio, combined with two Fast Track projects. The program received more projects aligning with the Process Loads TPM, while continuing to see small numbers of submissions in the Plug Loads and Appliances and Lighting Technology Areas.

Stakeholder Feedback

In Q4 2023, the program team organizations continued to engage their networks throughout the Deliverable development. The program team continues to gather feedback on the Scanning and Screening process and Deliverables, including issuing a Program Participation Satisfaction survey to submitters and hosting a quarterly scoring calibration meeting with partners. The survey was sent out on December 6 and the calibration meeting took place on November 29.

In the scoring Calibration meeting participants indicated the need for more clarity around the evaluation of tech transfer and stakeholder engagement. Participants suggested communicating with evaluators on where deviations in scoring have occurred in previous rounds and to send reminders to specifically focus on the scoring rubric. There was also a suggestion to add more clarity on cofounding policies and to potentially have an initial screening of cofounding sources before evaluating a proposal.

36 surveys were distributed on December 6, 2023. A reminder email was sent out on December 12, 2023, to encourage a good response rate. The program received 10 responses. This survey targeted specific questions related to their user experience during the Scanning and Screening process. The Q4 submitted surveys had mostly positive results. 40 percent of respondents reported being very satisfied, 30 percent were satisfied, 20 percent were neutral, and 10 percent were unsatisfied. CalNEXT program partners were the largest channel through which respondents found out about CalNEXT. Other notable channels included affiliated emerging tech or electric utility programs, CalNEXT program partners, webinars, colleagues and the CalNEXT website. Notably, none of the respondents cited social media. 90 percent of respondents said that they would consider submitting another project or idea and 10 percent said they were unsure.

The problems respondents ran into while submitting the application included differences in the PDF downloaded from the website and the submission form, an inability to insert hyperlinks, and not being versed in utility programs. One respondent mentioned that question 14a and 15 should have multi-select options. One respondent requested a table of utility energy efficiency programs to help submitters answer questions about which programs would be impacted. Some suggested more clarity on why projects were not accepted or misaligned with the program. Another submitter reported that they were told a program partner would reach out, but they never received any communication. This feedback has been documented by the program team and will be reviewed and potentially implemented as part of the periodic reviews and the continuous improvement process for the program.

For feedback on the project submissions, evaluator comments are gathered for project improvements and project decisions through Priority Framework Matrix scorecards and during Scanning and Screenings review meetings. The Project evaluation summaries (included in the Appendices) serve to provide feedback to the project submitter, share suggestions to improve the project, and to ensure stakeholder inputs are weighed to address any potential bias towards the specific technology or solution being studied that might impact final scoring and selection.

In Q4, the program team incorporated a variety of improvements from Q3 feedback. These improvements can be found in Table 6.

Table 6: Q4 Continuous Improvement Tasks by Status

Continuous Improvement Tasks	Status
Modify Freshdesk language regarding projects that involve proprietary technologies	Completed
Reduce response time for Freshdesk inquiries	On-going
Solicit Feedback from public submitters	Quarterly Activity
Implement recommendations derived from Q4 Survey	On-going
Update language of project submission in-take form	Completed
Update Dashboard for Committed Project tracking	Completed
Update Dashboard for Expected Project tracking	Completed

Recommendations

Recommendations for the Q1 2024 Scanning and Screening Project include:

- Begin analysis on current CalNEXT portfolio to begin planning for Q2 2024 Scanning and Screening.
- Participate in Outreach Events that target specific audiences, and that communicate portfolio needs, to solicit beneficial project and idea submissions.
- Continue to engage program implementers to get feedback on technology transfer opportunities in the program portfolio.
- Continue to work with program team partners to check in on the 2024 portfolio plan to ensure goals and key performance indicators (KPIs) for the program are on track.
- Identify additional projects as appropriate to meet 2024 portfolio needs, specifically focusing on project that can be both Committed and Expected in 2024.
- Continue to incorporate feedback from survey results to improve Scanning and Screening processes.

Appendix A Prioritization Framework Matrix Criteria and Weighting

Table 7: Prioritization Framework Criteria and Weighting

Criteria/ Category Weighting	Sub-category Weighting	Details
TPM Alignment/ Portfolio Priority (25%)	25%	Project aligns with the CalNEXT TPM priority areas. Projects that do not align have clear reasons why they should be approved through this Program.
Benefits (20%)	10%	Utility and Energy Efficiency Program Benefits: Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and EE programs.
	10%	Underserved Community Benefits: Project has defined clear benefits to Hard-to-Reach (HTR) customers and Disadvantaged Communities (DACs) and demonstrates a strong understanding of this customer segment.
Quality of Project (50%)	15%	Project Clarity: Project has clear scope and expected outcomes.
	15%	Innovation/Justification: Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research on the technology. It provides energy, carbon, or demand reduction estimates and calculations. If estimates are unknown, the Project suggests research in this area.
	10%	Project Readiness: Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the Project and deliverables within the estimated budget and timeframe.
	5%	Market Strategy: Project demonstrates an understanding of the market landscape and barriers, and feasible paths to engage the market. If unknown, the Project suggests research in this area.
	5%	Timeline: Project timeline estimates will demonstrate results within industry standards and research objectives (e.g., market characterization ~6 months, HVAC pilot 12 – 18 months to capture seasonality).
Cost	5%	Cost: Estimated budget range is reasonable given the research objectives.

Appendix B CalNEXT Scanning and Screening Process Flows

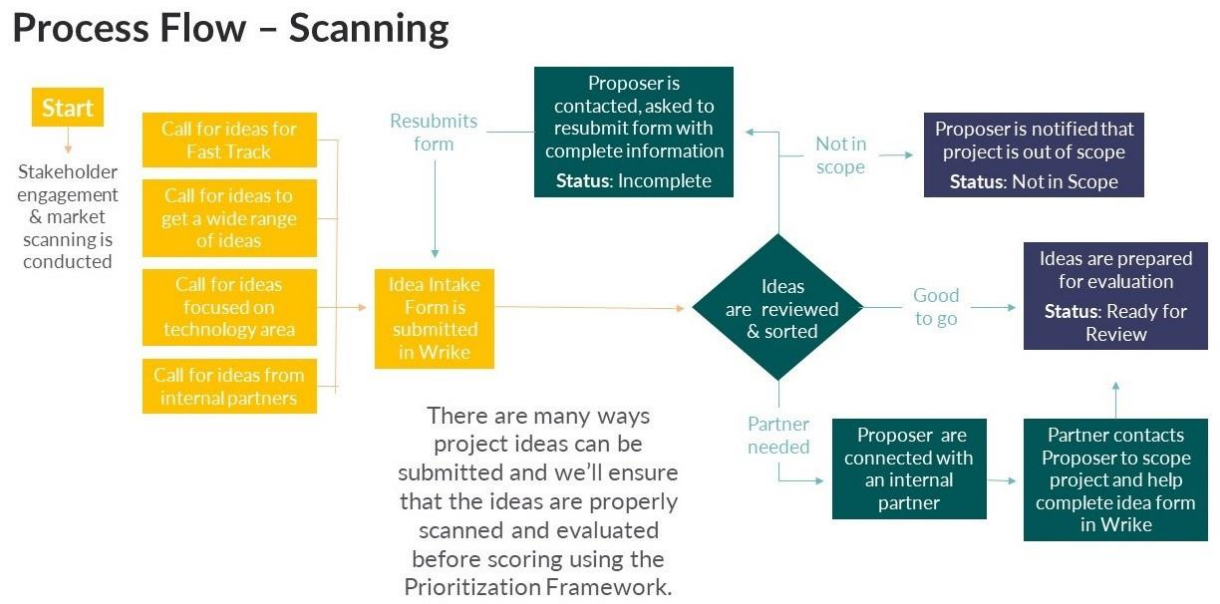

Figure 1: Process flow — Scanning

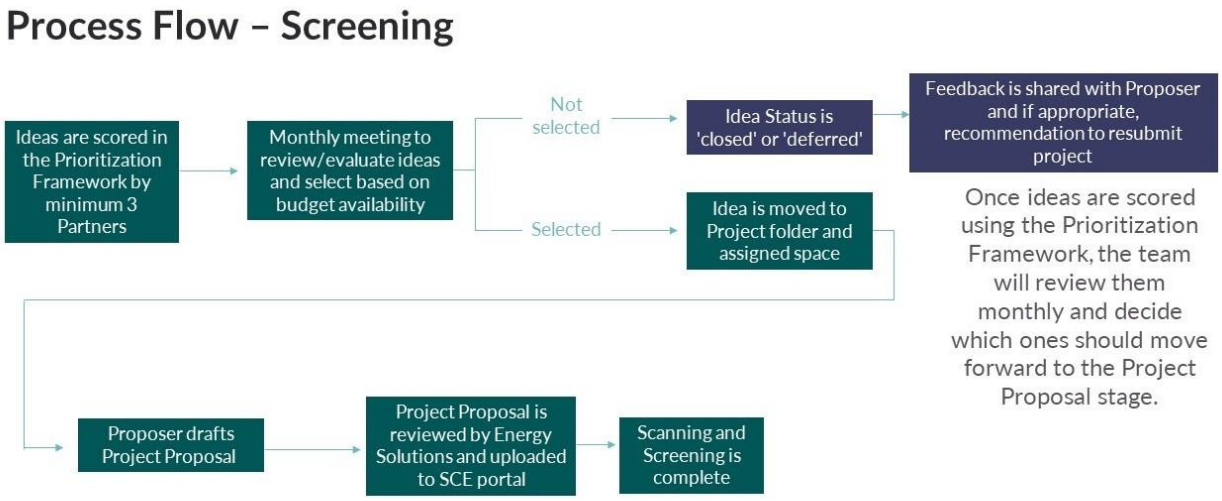

Figure 2: Process flow — Screening

Appendix C Fast Track Process Flow

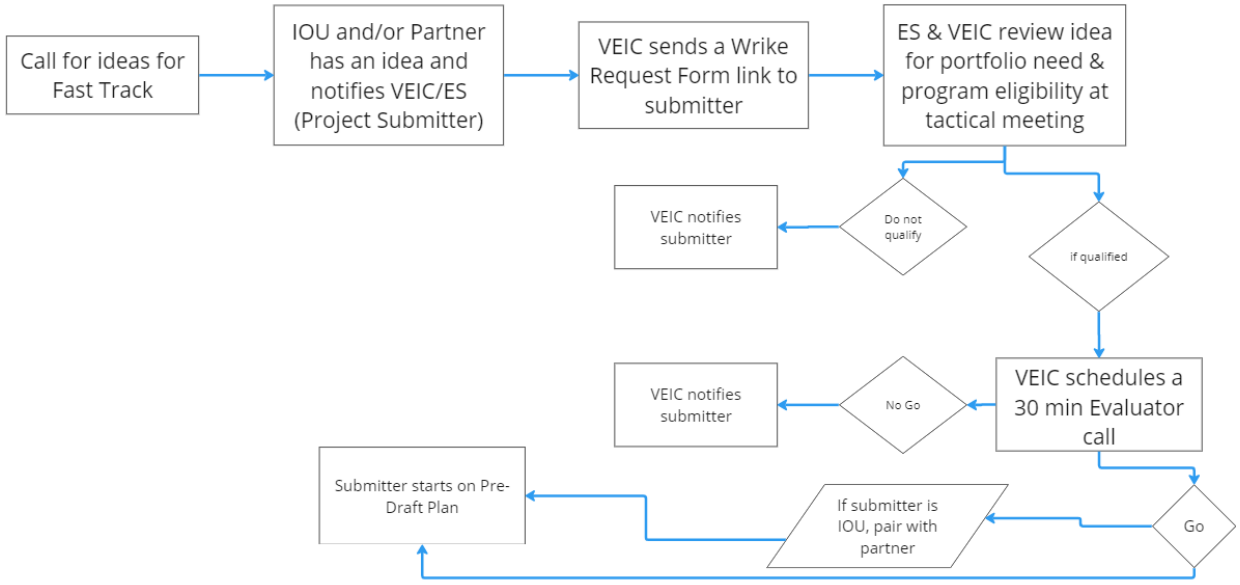

Figure 3: Fast Track process flow

Appendix D Advancing Natural Refrigerant Based Heat Pumps for All Electric Commercial Heating and Cooling in California

Design, model, test and demonstrate a R290 (Propane) and R744 (CO2) based heat pump system for all electric cooling and heating for commercial HVAC applications. High GWP synthetic refrigerants are being phased out on a federal level in the US. The use of propane as a low GWP natural refrigerant is limited due to its flammability. This project will demonstrate a safe and practical system which isolates the flammable refrigerant outdoors, and utilizes a carbon dioxide distribution loop that provides indoor cooling and heating with lower installation costs compared to hydronic loops

Project Details	
Submitter	EPRI
Project ID	1174424736
Technology area	Heating ventilation air conditioning (HVAC)
Project type	Technology development research
Research type	Field demonstration
Target market	Commercial
Timeframe	2 years
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• Although the proposal aligns itself to TPM priority, it neither explains how it works nor provides operating strategy, operating parameters, system details or set up. It is a misaligned proposal.

Feedback

• Natural refrigerant HPs align with High Efficiency Heat Pumps for Space Heating and Cooling and HVAC Design for Decarbonization, both of which are high priority areas

• High-efficiency heat pumps (Lead/High), HVAC Design for Decarb (Lead/High), Refrigerant Management & Low GWP Transition (Collab/Medium)

• Project does a good job describing the GWP (greenhouse gas) benefits, but should better describe the energy impacts compared to a propane air-to-water system

• This project would address two areas of the HVAC TPM, HE HPs for Space Heating and Cooling and HVAC Design for Decarb.

Technology Transfer and Program Alignment

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• It is an "early stage" concept while CalNEXT supports only commercially available technologies. It doesn't meet the funding criteria.

Feedback

• Project proposes lab testing and field demonstration of a natural refrigerant HP, and to provide measured data on the equipment performance

• It's not clear that there is a manufacturer open to distribute the technology after the project.

• Project should describe the relevant regulations and confirm this technology will be allowed to be installed in California, once Title 24 Part 4 adopts ASHRAE 15-2022 (which should happen as early as July 2024).

• There are some good outcomes listed for this project, but there is little mention of energy efficiency, mostly DR. Also, tech transfer into a program or measure package isn't well described.

Utility and Energy Efficiency Program Benefits

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Adequate details to satisfy the scoring criteria including EE, load flexibility and/or grid interaction would have been desirable i.e., how each of these criterion will be exercised and achieved?

Feedback

• Project has strong decarbonization benefits and will test potential DR capabilities. The energy savings will be measured as part of this project to inform equipment performance and program potential.

• Good description of GHG impacts, and there is a qualitative description of load flexibility. Energy impacts need to be better described or (if possible) estimated.

• This project would result in data needed in support of EE programs for HPs and load flexibility.

Underserved Benefits

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

• Project has articulated the likely benefits to HTR/DAC customers mostly in terms of improvements to IAQ. It might be a good idea to include more information about the anticipated lower installation costs mentioned in question 11. Also, IAQ and lower installation costs are benefits that community groups would support and easily understand. Future site selection for retrofit / case study would be possible using / coordinating with a community group or small business association working with SMB.

Project Clarity

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Provide additional scope details - system type (A2A, A2W), building details, baseline comparison, testing standards, component selection, control parameters, data to be collected, analysis methodologies, etc.

• The proposal states that R290 will be outside and CO2 will be inside but it doesn't elaborate how the two sub-systems are connected and work? Is it a cascade system?

• I would suggest adding more detail about capturing the potential benefits of energy efficiency. Is the focus more on DR than EE?

Feedback

• Project scope is loosely outlined, but lacks specific detail about the testing procedures.

• CalNEXT scope is not clear. Project mentions CalNEXT as cost share to CEC EPIC proposal. Not clear what CalNEXT project would do if CEC EPIC project is not funded.

• Need significantly more discussion on the system set up and its working principle.

• Outcomes are clearly defined

• The scope and listed outcomes are generally clear, but more detail could be added in the scope section.

Project Innovation / Justification

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• It aims to "Design, model, and demonstrate a Heat Pump prototype of 5Ton capacity for testing in a laboratory, followed by design, model, optimize and develop a 20 Ton Heat Pump to be tested in a low occupancy conditioned space for proof of concept.

Feedback

• Natural refrigerant HVAC solutions are high priority and this project seeks to test one configuration
• Safe application of propane heat pumps is needed to meet decarb goals
• The proposal has merit to be innovative provided it conveys the missing parts. The proposal is mis-aligned and risky, particularly, when proof of concept is currently missing.
• Clearly describes how it's different from incumbent technology, but estimates are not known. That seems reasonable, since this will be one outcome of the research.
• The project is innovative by splitting up propane and CO2 portions of the system design. Performance determination is part of the scope listed.

Project Readiness

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Consider whether it makes sense to split this project into 2 phases so that the results of the lab testing on the 5-ton unit can be used to inform the design and demonstration of the 20-ton unit.
• No critical partners were identified

Feedback

• This is a big project with multiple phases. I think it's important to consider the learnings and communicate the results of the first phase before designing and implementing the proposed second phase.
• There is not a clear path to meeting project goals without CEC EPIC funding.
• Not really
• Partners are identified.
• The partner section lists the need for "letter of intended support" by CalNEXT before 9/15. Since that date has passed and this project hasn't been through scoring yet, can it be completed with the partners listed? It's unclear. Also, it would be good to research and describe the charge limits for propane HP systems that would be used in these applications to ensure no regulatory barriers exist.

Stakeholder Engagement

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Provide potential industry stakeholders that will contribute to the data collected in outcomes 7 & 8
- Unknown?

Feedback

- Project partners and co-funding sources identified.
- Project partners are listed generically (i.e. equipment suppliers, construction partner, etc.)
- Besides the project partners, stakeholders are not identified, and there is no discussion of stakeholder engagement
- The stakeholders are not listed and how they will be engaged.

Timeline

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- How does the timeline shift now that we are past the 9/15 submission deadline for EPIC 22-308?
- 2 years is too long from CalNEXT perspective, although this project can't be completed below 2 years as it aims to build and test 2 prototypes.

Feedback

- Timeline seems reasonable for the full scope, but recommend splitting into 2 projects.
- Timeline seems short to develop and test two new heat pump technologies.
- 2 years is too long from CalNEXT perspective, although this project can't be completed below 2 years as it aims to build and test 2 prototypes.
- Project timeline is 2 years, which is lower than the suggested timeline. But given the scope of the project, 2 years seems reasonable.
- The project's timeline is listed as 2 years, but later references spanning 2023 to 2026, past CalNEXT program end date.

Cost

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Provide additional cost details for each outcome.

- $300K?

Feedback

- Cost estimate seems reasonable for the full scope, but recommend splitting into 2 projects
- Cost seems low for scope
- Project scope includes modeling, lab testing, and 1 field test. $400K seems on the high end, particularly given match funding, but within reason.
- The budget estimate seems high. Suggest paring down the expected outcomes to achieve in 18 months and within a smaller budget.

Appendix E Advancing Whole Building Measurement Methods

Energy Efficiency and Demand Side Management programs need to adapt offerings to meet the needs of a rapidly changing grid, maximize climate benefits, and best serve customers. However, regulators, utilities, and implementers face immediate barriers when attempting to evolve toward more comprehensive, holistic, and integrated whole-building program designs:

- Programs are often limited to specific measures with predetermined savings.
- The interactive effects between individual measures are difficult to calculate, and concerns over double counting can lead to limited measure packages and/or additional program requirements.
- The contractor and technician workforce is often specialized, with businesses built to address only specific end uses (HVAC, lighting, refrigeration etc.).

Each of these barriers can be traced in part or in full to one common cause: Program savings need to be quantifiable, and program administrators need to be accountable for those results.

The energy efficiency and demand side management industry need a way to give programs the flexibility to integrate technologies and scope projects based on the needs of individual customers while maintaining (and even enhancing) the ability to measure and quantify savings results.

Fortunately, with the advent of smart meters, whole building consumption data that can enable rapid and reliable measurements of an integrated program's impact are more available than at any time before. One of the leading approaches to provide these measurements is OpenEEmeter, an open-source methods and codebase, which have made performance-based demand management programs that are measured "at the meter" possible.

While this progress has been promising, the OpenEEmeter methods have not been significantly updated since 2017. Since that time, solar PV adoption has doubled, building electrification has become a major statewide objective and focus of programs, the electric vehicle market has grown by an order of magnitude, and integrated energy management devices have become commonplace. These changes, alongside traditional efficiency strategies, present opportunities for programs to convert buildings into efficient and coordinated grid resources while also saving customers money. However, they need to be measurable, especially when implemented in concert. This project will develop and test OpenEEmeter 3.0 hourly methods.

Project Details	
Submitter	Energy Solutions (and Recurve Analytics Inc.)
Average score	58.00
Score deviation	12.87
Project ID	1238937311
Technology area	Whole building
Project type	Technology development research
Research type	Tool development/enhancement
Target market	Residential
Timeframe	12 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions

Evaluation Category	Results
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 7.5 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• While not explicitly stated, I believe this should fall in the Whole Buildings - Operational Performance TPM. See here: https://calnext.com/resources/whole-buildings/

Feedback

• This project, which is a measurement protocol for use in a demand side management of buildings and systems or for use in more accurately capturing EE savings, most closely aligns with community Scale Strategies, which is a Low priority tech family. It indirectly addressed key needs of the tech family.
• Project proposes work for a low priority technology family. Description did addressed "Opportunities" and "Barriers" relevant to that family.
• The core project idea is related to better modeling of benefits from Solar PV systems. While NMEC is considered for CalNext Whole Building TPM as a 'Lead' with 'Medium' priority, the focus is on EE measures.
• Project directly addresses key needs identified in the “Opportunities” or “Barriers” section of a medium priority technology family. For projects that do not align with the TPM, reasons shared had good justification for this program.

Technology Transfer and Program Alignment

Average Score: 6.5625 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Open-source does not guarantee tech transfer or program adoption. Please provide additional details on the impact this project could have to the utilities and how this work can help improve tech transfer and/or market adoption.

Feedback

- Project is well positioned for integration into utility DSM programs. A direct path is described explaining how Technology Transfer can be achieved in the long or short term.
- Proposed project has limited impact to utility EE/DSM programs.
- The idea mentions how TECH could benefit from this effort. However, it is unclear how CPUC funded EE programs can benefit from better modeling of Solar PV performance.
- Project has some potential to effect utility EE/DSM programs with more accurate modelling of baseline measurements.

Utility and Energy Efficiency Program Benefits

Average Score: 8.4375 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Please describe tangible benefits that this project could provide for EE programs.
- Project seems to focus on more demand-side management programs compared to energy efficiency. Consider submitting to DRET (Demand Response Emerging Technologies Programs) instead.

Feedback

- Project has strong benefits to the utilities by more accurately measuring the load shifting potential. However the benefit to EE programs is indirect as it may offer an improvement to TRM deemed values.
- No benefits to EE programs was provided
- It is unclear how CPUC funded EE programs can benefit from better modeling of Solar PV performance which is at the core of this project.
- Project has moderate benefits to the utilities. While accurate metering, forecasting, and modelling is important for demand-side management, there are no direct benefits to energy efficiency programs.

Underserved Benefits

Score: 3 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Average Score: 6.25 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Including formation about how possible methods will be tested and refined.
- More details are needed to clarify the goals of the proposed project and how all of the data requirements can be achieved in a 1-year project.

Feedback

- Scope is only somewhat clear. No examples are given of possible modern time series forecasting methods that will be considered. Unclear how possible methods will be tested and refined.
- Scope and outcomes are not clear and do not seem achievable in the proposed timeframe.
- Scope and expected outcomes are somewhat clear and reasonable and probably achievable

Project Innovation / Justification

Average Score: 6.25 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- Please clarify how this project is different from other BMS systems that will integrate all the stated technologies. Provide more details for how much modern machine learning techniques will improve over the incumbent methods. Lastly, provide estimates for energy, carbon, and demand reduction

- What are the differences between this project and the working group developing the open source CalTRACK technology? Will the project be working with the GitHub contributors? https://github.com/openeemeter/caltrack

Feedback

- Project indicates moderate to strong differences from incumbent measurement methods by incorporating all forms of integrated DSM (solar PV, battery storage, etc.) and it will include solar irradiance data.
- Differentiation from past work and improvements to incumbent technology is unclear. Additionally, no energy, carbon, or demand reduction estimates or calculations were provided.
- Project indicates slight differences from CalTRACK 2.0 technology and/or research or is similar to completed or in progress research projects. It has limited information on energy, carbon, or demand reduction estimates.

Project Readiness

Average Score: 6.25 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide additional details for how potential pitfalls will be addressed. When updating scope and outcomes, include more details for how this project could be completed in the proposed timeframe.

Feedback

• The Project has good information about how it will be delivered and has identified a key partner in Linux Foundation Energy (LFE). Information indicates that the project has good chance of success within the estimated budget and timeframe.
• Project patterns have been identified, but it is not clear if project team has additional hurdles to navigate to get the historical data that is described in the proposal. Since the scope and outcomes are unclear it does not seem like this project will be successful for the proposed timeline.
• The Project has good information about how it will be delivered and has identified partners. Information indicates that the project has good chance of success within the estimated budget and timeframe.

Stakeholder Engagement

Average Score: 5.625 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Open-source is one step, but more details are needed to understand how the information from this project continues to move toward the market.
• Although the code is open source, there should be a strategy to increase engagement, adoption, and market acceptance of the technology.

Feedback

• Project demonstrates a moderate understanding of the market landscape and barriers, and feasible paths to engage the market through the development of open source methods and code.
• Project does not demonstrate an understanding of the market landscape.
• The project outlines one pathway for market adoption - TECH and programs using NMEC approaches. However, it is not clear how the lack of modeling solar PV in CalTrack is a barrier to EE/electrification measures.
• Project demonstrates a limited understanding of the market landscape and barriers, and feasible paths to engage the market nor does it include this type of research in project scope.

Timeline

Average Score: 4.0625 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Provide details for how a whole building study can be completed within the proposed timeframe or edit the scope/outcomes/timeline to better align with requirements.

Feedback

- Project timeframe estimates of 12 months are within industry standard timeline given the scope and expected outcomes
- Project timeframe is unreasonable given the scope and outcomes.
- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes.

Cost

Average Score: 4.0625 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Please provide more details for how this budget fits the given timeline, scope, and outcomes.

Feedback

- Budget estimates of up to $200,000 are realistic and aligned with the program expectation. No cost sharing was identified.
- Project cost estimates do not align with the scope and outcomes.
- Budget estimates are realistic and aligned with the program expectation.

Appendix F Characterization of Central Heat Pump Water Heating Deployment in the Multifamily Market

Water heating energy use in multifamily buildings can account for 27 to 32 percent of total energy use based on 2015 Residential Energy Consumption Survey by U.S. EIA. Heat Pump Water Heating (HPWH) systems use electricity to produce hot water by transferring heat energy from one source, typically air, to potable water. The 2022 Title 24 Statewide All-Electric CASE research suggested central gas-fired DHW systems are common in most multifamily buildings, except for those with a small number of dwelling units. Central HPWH systems (CHPWHS) are an important technology to decarbonize multifamily buildings. While a variety of residential HPWHs are available to the single-family residential market, CHPWHS are relatively new technology, with limited field installations in multifamily buildings in California. Field research is finding that many early HPWH installs in centralized applications with continuous recirculation systems before 2020 are not performing well. In a typical multifamily building where HPs have been installed and commissioned appropriately has endured steep installation and commissioning challenges and associated cost and are operating at a lower system COP than anticipated. There are several gaps that this study will address. There is a lack of comprehensive data on field HP system designs and existing installation practices. This study will identify system types and compare the configuration with established configurations listed by NEEA in their Advance Water Heating Specification publication. It will document the refrigerant used, water temperature parameters, storage volume and output capacity and storage vs. capacity ratio. This project will note operational data on what type and how HP controls are being utilized, how mixing valves are configured and if the systems use back-up water heating and how it is configured. Lastly, the team will document purchase and installation costs.

This project will conduct a market characterization of CHPWH deployment barriers and opportunities for multifamily buildings. The goal is to identify products, as well as system design approaches, that are currently being deployed in the market, researching if these products are meeting demands of multifamily buildings (heating capacity, storage gallon capacity, backup resistance capacity), identifying barriers to development, investigating alternatives to a CHPWH system in a building such as clustered systems, and code allowance of CHPWH products. The project team will: a) review real-world installation data from the TECH, Energy Smart Home, SMUD programs to characterize system selection and design practice as well as installation costs, and b) interview multifamily building owners and equipment manufacturers to assess interest in installing CHPWH and associated challenges, and c) interview manufacturers to discuss their current and future product offerings, recommended system design approach, and their challenges with product development.
The project team envisions this effort as one of three projects on CHPWH technology in multifamily buildings ultimately leading to new measure development or updates.

Project Details	
Submitter	TRC
Average score	78.75
Score deviation	8.35
Project ID	1221046132
Technology area	Water heating

Project Details	
Project type	Technology support research
Research type	Market characterization/study
Target market	Multifamily
Timeframe	12 months
Funding request	Up to $100,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority
Average Score: 10 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- Even with the research aspect of the project focused on MF, you could expand the research on existing installations to go beyond MF buildings, or possibly include some mixed use buildings if available to get insight on gaps beyond MF.

Feedback

- Strong alignment with TPMs and will provide specific insights on opportunities and barriers for CHPWHs in multifamily applications.
- This aligns well with the TPM, like the part about researching existing installations to determine if they are performing as intended.
- Project aligns with the commercial duty water heating tech family in WH TPM with high priority and CalNEXT lead.

Technology Transfer and Program Alignment

Average Score: 12.1875 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- recommend engaging the existing programs as part of completing this work

Feedback

- A market characterization of CHPWHs for CA would definitely serve to expand support of multifamily applications by IOU PAs. Specifically would inform updates to the eTRM.
- Needs more detail on how results may be used to updated eTRM, what gaps may be addressed,
- Project will provide information to be used to improve future manufacturer development, field testing, evaluations, and program design based on market conditions and needs. Path to transfer and program development is slightly indirect since it depends on a series of proposed studies (this is one of three).

Utility and Energy Efficiency Program Benefits

Average Score: 15 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Tech does have significant potential for EE savings, but not clear how project will increase adoption or what the Tech Transfer steps are for the info to influence future projects and program design.

Feedback

- Reporting on existing CHPWH designs and performance data offers an opportunity to improve COP/EE of systems in future (and existing?) systems.
- CHPWH measures have GHG, demand flexibility, EE, and decarb benefits directly for utilities and programs. The project will help towards that realization.

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

PROJECT IMPROVEMENT SUGGESTIONS

- Include HTR/DAC stakeholders in the study either as participants in the survey, or as relevant stakeholders on par with NEEA, MBI, etc

Feedback

• Proposal states a) lots of MF buildings exist in DAC HTR and b) developers building in DAC/ HTR already have incentives available to them when they choose "Central." Reader is not clear on what the benefit of this program is to DAC/HTR when there seem to be existing levers to encourage adoptions / installation (see response to q. 18). However, later in the proposal, developer explains that "very limited incentives are available for central heat pump water heaters resulting in low uptake of the technology." DAC/HTR stakeholders were not included or called out to engage with the project as relevant stakeholders; and any effort to speak with LI / HTR / DAC M builders / developers to gain from their experience wasn't called out.

Project Clarity

Average Score: 7.5 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Recommend including TECH MF CHPWH projects as a source of data as well. Include specifically what data will support the measure package update
• the outcomes could be more clearly defined, what are you hoping to find and how will you use that information?

Feedback

• Scope is clearly defined.
• Needs more specifics on expected outcomes, how the project will inform the program design,
• Scope is well defined and reasonable. Individual scope tasks are clearly listed.

Project Innovation / Justification

Average Score: 7.5 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• The review of existing installations stands out to me, it would be great to have goals on how many or types of installations will be reviewed and what different characteristics will be included such as CO2 refrigerant or intended load shifting.

Feedback

• Although the project clearly identifies external sources and studies, it does not identify existing/ongoing CalNEXT projects that overlap, align and could support/inform this project.
• How is this different than existing CalNEXT projects and other ongoing research? Proposal references that this is 1 of 3 projects that could lead to new measure development or updates. What are the other two projects? Are all three needed for measure development and/or updates?

• The proposed line of study does have some overlap with other recent reports, although not all relate only to California. So, there is some redundancy. However, this technology and market is evolving and does need repeated attention, especially now that there are more experienced stakeholders to engage. Resubmission focuses more on engagement with experienced designers, end-users, and manufacturers than previous.

Project Readiness

Average Score: 9.375 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

Feedback

• Project clearly identifies critical pathways and partners to complete the project.
• Need more detail on how they would accomplish tech transfer goals and how they will engage with critical partners. Have listed stakeholders agreed to participate? Do they have existing relationships with the stakeholders and critical partners?
• Project lead has a clear understanding of the stakeholders, paths to engage, and relationships to leverage to achieve scope.

Stakeholder Engagement

Average Score: 8.125 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Recommend clearly identifying other CalNEXT projects/partners and any potential engagement in the project. TECH incentivizes MF CHPWHs, recommend listing Energy Solutions as a TECH stakeholder.

Feedback

• Project does not identify any CalNEXT partners with existing multifamily CHPWH projects and potential engagement.
• Need more info on existing relationships and past interactions with stakeholders to better understand likelihood of successful engagement.
• appreciate the inclusion of building owners
• Project lead understands the various products, CHPWH designs, and identified barriers to the technology. That will set them up for a solid project plan and execution.

Timeline

Average Score: 4.0625 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

• could use the time to engage with building owners over a period of time to see if and how the system operation changes seasonally

Feedback

• 12 months seems appropriate
• Likely will take more than 12 months once program deliverables are fully considered.
• this is a bit long for a market characterization
• 12 month timeline seems a bit long for a literature survey and stakeholder engagement study. Even so, 12 month timeline could be okay since it will still complete by end of 2024, contributing towards CalNEXT 2024 goals.

Cost

Average Score: 5 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

Feedback

• $100k is appropriate
• $100k cost is reasonable given the tasks.

Appendix G Commercial Kitchen Heat Pump Assisted Water Heater Field Demonstration

Commercial foodservice has been identified as one of the highest priority sectors for heat pump water heater research. Recent study has estimated a market size of about 68,000 commercial foodservice facilities in California. This sector has by far the highest energy use intensity (energy per square foot) of the major commercial building types and water heating in foodservice accounts for about 16 percent of all California commercial gas usage. So, it follows that foodservice water heating requires energy efficiency research attention in the face of electrification and the vast greenhouse gas emissions reduction potential.

A commercial kitchen serving 2,000 meals per day is being retrofitted with a bank of integrated heat pump water heaters coupled with chiller heat recovery preheating and a gas heater for trim and temperature maintenance loads. This hybrid, dual-fuel heat pump assisted water heater system is a novel decarbonization design addressing the electrification and energy efficiency needs of this important, unaddressed end-use. This CalNEXT project will measure and monitor key system datapoints for evaluation of performance of this unique system. The design, market implications, and recommendations for market actors and programs will be discussed based on the performance findings.

Project Details	
Submitter	AESC and ASK Energy
Average score	68.75
Score deviation	13.58
Project ID	1238873508
Technology area	Water heating
Project type	Technology support research
Research type	Field demonstration
Target market	Commercial
Timeframe	18 months
Funding request	Up to $300,000

Evaluation Category	Results
Technology priority maps	No recommendations
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 10 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

Feedback

- Field test of dual fuel HPWHs

Alternative solution to support HPWH adoption but meeting code requirements for food service

- Project directly addresses key needs identified in the "Opportunities" or "Barriers" section of a commercial-duty water heater technology family.
- TPM alignment is good

Technology Transfer and Program Alignment

Average Score: 12.1875 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- If available, provide any additional guidance how this project would leverage existing programs
- The potential need for a synthetic baseline reduces the impact of project outcomes.
- Suggest adding Demand response or load flexibility component with the HP. This all is based on the added storage capacity and controls to turn off HP during Peak periods to lower operating cost and expand benefit to the grid.

Feedback

- Identifies multiple long and short term pathways to support EE and C&S programs. It is unclear if IOU PAs are already positioned to support HPaWHs in foodservice projects.
- Project is well positioned for integration into a new or existing program, or to scale the adoption of a technology. Technology Transfer pathway is broadly described but likely aligns with the commercial-duty TPM.
- We have a lack of data for HP Assist and for chiller HR for this application and this monitoring project will be helpful

Utility and Energy Efficiency Program Benefits

Average Score: 10.3125 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Clarify whether any demand response or load shifting might be part of the project.
- Please provide more details for expected total system benefits, kW and kWh savings, total resource cost, and lifecycle kWh savings.
- Monitoring energy savings from each individual measure is needed as likely the heat recovered from the chiller will lower the COP of the HP and vise versa.

Feedback

- Demonstration of larger HPaWS system with chiller, which speaks to meeting peak demand required by code, but not related to any demand management opportunities.
- Project has moderate benefits to the utilities and energy efficiency programs.
- The heat recovery from chiller is hard to transfer to a utility program benefit. The combined savings from chiller HR and HP are not usable together for incentive program development

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

PROJECT IMPROVEMENT SUGGESTIONS

- If site selection for the field demo has not been completed, consider picking a site located within a DAC. https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

Project Clarity

Average Score: 6.875 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- The potential need for a synthetic baseline reduces the impact of project outcomes.
- Add timelines for each step and clarify if a site has been identified
- Suggest getting site commitment to gather measure cost and operating cost info prior to proposal resubmittal. System operating costs pre and post should be estimated at minimum if not directly measured and calculated using customer energy rate information. The project report should include justification for design, details on commissioning of measure system. Suggest adding monitoring of recirculation system for flow and supply and return temperature to calculate pipe heat losses to back out the thermal efficiency of the gas water heater. Otherwise without base case monitoring, the extrapolated energy use could be way off. Documentation of the distribution system layout, pipe insulation and specification, type and quantity of hot water using equipment would be valuable information. The latter to understand health department water heater sizing for recovery rate (2nd hour peak use) versus actual results from monitoring. Adding analysis for sizing dedicated HP systems based on findings and also through using existing health department sizing guidelines would be helpful. Add scope tasks to monitor the measure system with chiller addition only or with HP Assist only to quantify the energy savings of each aspect separately and also the impact on HP

COP. This would require valving in and out each system and is doable since the existing gas water heater can already meet the full load. Knowing the savings from HP Assist only or chiller HR is more applicable to help utility programs create incentives versus combined savings.

Feedback

- Scope is clear.
- Scope and expected outcomes are generally clear, reasonable, and achievable.
- would like more clarity in 25 on the steps and timelines of the project.
- Enrolling the building owner of a commercial kitchen undergoing a HPA WH Retrofit through a known designers is unclear. There are a lot of deliverables mentioned that are optional including gathering purchase and installation information, completion of pre-retrofit monitoring, calculating pre and post operating costs. Missing information dissemination section to key stakeholders including presentations at conferences and to key local stakeholders. System Performance section can be improved.

Project Innovation / Justification

Average Score: 8.125 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- If possible, provide more detail for possible energy, carbon, or demand reduction estimates.

- Would be great to quantify the gas needed and determine methods to reduce or eliminate the need for dual fuel.
- What is the overall savings potential from chiller HR and in which commercial kitchen segments? Discuss other forms of heat recovery (refrigerant heat recovery, drain water heat recovery) in commercial kitchens that can be utilized to expand applicability to more sites in California. Provide details on the design and overall configuration. How will the warm chiller water impact the performance of the HP? Is chiller water preheating HP storage tank or the gas system storage tank? More details on single pass versus multipass HP, series or parallel tank configuration, location of inlets and outlets, etc is needed to gauge performance of this system to justify and understand the level of innovation. Also information on system controls and commissioning process is needed to gauge likelihood that the system will be optimized. Provide estimates of energy savings from chiller HR, HP and reduction of gas water heater use. Provide estimates of operating cost pre and post to help justify this project and level of innovation. Are there opportunities to reduce hot water use in the facility to deliver a cost offset or operating cost savings or minimize gas use further?

Feedback

- Addressing peak demand code requirement issues with HP design with assisted gas heater.
- Project indicates moderate to strong differences from incumbent technology and/or research and is not similar to completed or in progress research projects. It has limited information on

energy, carbon, or demand reduction estimates but includes some calculations and research on this as part of the project.

• The concept of chiller heat recovery, HP and existing gas system is complex and needs significant explanation. If poorly specified, designed and commissioned, it can lead to breakdowns, low COPs and no payback. This is an exciting system to monitor but the chiller heat recovery portion is atypical to most commercial kitchen applications.

Project Readiness

Average Score: 6.875 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Could there be a backup alternative site if the project kickoff will not meet HPaWH installation timeline?
• The potential need for a synthetic baseline reduces the project readiness.
• It is not clear if there is a site in mind, but it seems like there is. If so that would be helpful to understand and know more about.
• Provide details on when monitoring equipment will be installed. During equipment retrofit or after? Is ISNET certified contractor been identified to support installation of monitoring equipment if cutting pipe or installing electrical metering equipment? Since the site has been identified, a site committment letter with commitments to provide installed and operating cost information would enhance project readiness.

Feedback

• Raised question of baseline M&V timing to align with active project timeline.
• The Project has good information about how it will be delivered and has identified partners. Information indicates that the project has good chance of success within the estimated budget and timeframe.
• Hard to gauge project readiness with information and details provided.

Stakeholder Engagement

Average Score: 6.875 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Include utility PAs overseeing custom incentive programs
• Please provide a comprehensive list of stakeholders, explain the impact this work will have for each, and how they will be engaged in the project.
• Suggest expanding scope to include information dissemination deliverables to present findings at relevant efficiency, restaurant and plumbing design (ASHRAE, ACEEE HW and Air Forum, FCSI, AWHI, etc), and health department (CEHA) conferences. Engagement during the project should

include the local health department plan checkers to ensure they are part of this process and it is an opportunity to educate them on findings directly.

Feedback

- Identifies key stakeholders, but not any utility Pas important for potential tech transfer needs
- Project describes who stakeholders might be and how they will identify and engage stakeholders as part of the project.
- This section is very slim and can be expanded

Timeline

Average Score: 4.375 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Suggest expanding to 24 months

Feedback

- 18 mo. timelime is appropriate.
- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes.
- Is short if intention is to do 6 months of pre retrofit monitoring, likely commissioning time will take time prior to gathering a minimum of 6 months of post retrofit data.

Cost

Average Score: 3.125 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Budget upper range seems a little higher for M&V and market research. Please provide more detail for how use of synthetic baseline could change overall budget.
- Suggest adding measure equipment commissioning support during the monitoring period to optimize the system. Add information dissemination deliverables. Change some of the if possible clauses for tasks to ensure they are actual deliverables. Add monitoring of chiller HR and HP seperately to quantify individual component savings and combined system energy savings reduction.

Feedback

- Budget seems reasonable
- Budget estimate is somewhat realistic but higher than expected and relative to scope/outcomes.

- seems reasonable but hard to tell without more information on the scope and timeline.
- The funding amount is high since the site has been identified, no equipment will be designed, purchased or installed through this monitoring project and possibly there will only be post retrofit monitoring completed based on the timing of the project for only 6 months.

Appendix H Commercial Ultra-Low GWP Heat Pump Field Demonstration

Space heating needs in large buildings have historically been met using fossil fuels and combustion-based equipment to generate hydronic hot water. As California transitions to electrifying space heating systems, heat pumps and heat recovery chillers offer a viable option for traditional airside HVAC applications. However, heat pump applications in large commercial buildings have challenges, such as higher first costs compared to fossil gas systems, lower operating efficiency at higher supply temperatures, and limitations when operating at low ambient temperatures. This project focuses on field evaluation of a decarbonization solution that includes integration of a large-size (> 100 ton), standalone ultra-low global warming potential (GWP) refrigerant (GWP< 10) heat recovery chiller into a conventional central plant system to reduce existing gas boiler load. The demonstration partner, Genentech, has an ambitious decarbonization goal, including retrofitting the central plant system of a large office/building (>140,000 sq. ft.) that currently comprises gas boilers (situated within the building, the peak heating load > 6,000 kBTU/hr or 500 ton) and a satellite chiller (normal capacity of 1,000 ton, to meet a peak cooling load of > 1500 ton) connected to a district chilled water network.
Our approach to the study consists of these specific steps:

- Finalize integrated design solution with the project partner
- Collect baseline data to supplement and verify three-plus years of historical data already collected at the site
- Collect post-retrofit metering data
- Conduct measurement and verification analysis to estimate energy use, peak demand, load shifting, and greenhouse gas emissions
- Conduct interviews and/or surveys to gauge facility operator/manager satisfaction with equipment deployment, commissioning, maintenance, and servicing
- Report performance of the low-GWP heat recovery chiller along with overall system operational efficiency of the integrated design, deployment obstacles overcome, and lessons learned

The overall objective of this demonstration project is to evaluate the performance of a new large central plant incorporating a low-GWP refrigerant heat pump. The lessons learned from the integration strategy and performance analysis will be used to inform refrigerant codes, utility programs, and accelerate wider adoption of environmentally friendly technology in California's large building market sector currently dominated by typical central plants.

Project Details	
Submitter	TRC
Average score	65.94
Score deviation	14.48
Project ID	1239093862
Technology area	Heating ventilation air conditioning (HVAC)
Project type	Technology support research
Research type	Field demonstration
Target market	Commercial
Timeframe	2 years
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 8.75 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- It would help to identify the key insights to be pursued, rather than stating the project will consequently accelerate wider adoption.
- Numerous systems are now available commercially using ultra low GWP refrigerants with their well documented performance. What's new?

Feedback

- Project explicitly aligns with named TPM family and area.
- HVAC Design for Decarb high priority, CalNEXT lead (also aligns with other tech families).

Technology Transfer and Program Alignment

Average Score: 12.1875 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- It would help to describe a plan for the tech transfer to occur.
- Would be helpful to have clear direction on technology transfer and program alignment.

Feedback

- There is an uncontroverted fit within existing utilitiy programs, but tech transfer is unclear.
- Proposal doesn't elaborate this requirement
- Custom HVAC program alignment. Will help illuminate challenges and solutions for supporting low-gwp heat recovery chiller measures through program support. Tech transfer of case study development and tech support.

Utility and Energy Efficiency Program Benefits

Average Score: 10.3125 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- The project doesn't elaborate on benefit utility programs with electrification, load flexibility, new measures, and savings for utility programs

Feedback

- The technolology type has benefits to utility programs, but it is unclear how the findings of the project will benefit utility programs. How do we know it will accelerate utility programs and adoptions? Is high performance already known and study is therefore not needed? Might performance be poor and new barriers uncovered? The owner is doing this project without utility incentives, ostensibly because of a corporate directive and pricing of carbon. How is this translatable to utility programs and the CA market as a whole?
- Proposal doesn't elaborate this requirement
- Heat recovery chillers have clear EE and decarbonization benefits over typical chiller/boiler systems. Low-GWP models will also have additional GHG program benefits.

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

PROJECT IMPROVEMENT SUGGESTIONS

- Check properties owned by ROCHE / Genetech to see if any prospect sites are located in a DAC using CalEnviroscreen 3.0 tool located here: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

Project Clarity

Average Score: 7.5 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Equipment details may be helpful to bring confidence in the study
- The proposal describes that load shift between the measure and baseline will be evaluated for "improved control periods." It is not clear whether the baseline is the existing chiller/gas boiler system or whether load shift controls will be added to the proposed measure with the baseline for that being some standard heat recovery chiller controls. M&V and the value will be different depending on that.

Feedback

- Market landscape response is lacking any information on the market (manufacturers, distributors, retailers, installers/contractors/technicians, customers, existing programs & incentives, etc.).
- Any equipment details, size, compressor types, refrigerant, temperature of supply hot water, … site, when, …?
- Scope is clear and achievable, except for the "load shift" portion. The definition of the "load shift" is not clear. Otherwise, the scope identifies important tasks and how they will be achieved.

Project Innovation / Justification

Average Score: 6.25 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- In view of energy efficiency and GHG emissions, there is a wider acceptance to limit the hot water temperature to 130F. Stressing the necessity of 180F defeats the purpose of ET.
- It is not clear how the load shift "improved controls" function and if they innovate over typical chiller controls.

Feedback

- Heat recovery chillers have been utilized in commercial heating cooling and heating applications for decades. The proposal identifies barriers to application, but it is not clear how doing this project will address those barriers. The proposal states "results will encourage potential adopters and increase stakeholder confidence." How do we know the results will not be discouraging? How can we state this without bias?
- Unclear if commercially available. Answer to #12 says yes, but a proposed barrier is "uncertainties regarding the long-term performance of pre-commercial stage heat pump equipment".
- How water temperature should be limited to 130F as much as possible, and not 180F.
- Heat recovery chiller is justified and has benefits over chiller/gas systems, as do low-GWP over legacy refrigerants. Savings estimates are included.

Project Readiness

Average Score: 9.375 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

- Both time and budget seems excessive
- GHG factors are available for California climate zones from Title 24/CEC efforts and should be used instead of or in addition to the EPA factors called out in the proposal.

Feedback

- Project appears to have the appropriate partners and path to completion.
- Project is ready and good chance of success. Partners and host site are identified.

Stakeholder Engagement

Average Score: 6.25 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- It would help to involve stakeholders including distributors and designers to understand the dynamics of the process and its uptake.

Feedback

- How would the results of interviews from one installation provide conclusive findings?
- Proposal only lists potential stakeholders, but does not discuss any plans for how they will be engaged.
- Broad set of possible, relevant stakeholders identified, but not explicitly named.

Timeline

Average Score: 3.125 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- 2 year duration is quite high, particularly when such systems are readily available and are used commercially.
- I would suggest that full year baseline and post periods are not necessary, from a weather and normalization perspective. Nine months should suffice.

Feedback

- Two years is longer than expected for CalNEXT pilots.
- Two year timeline will not allow for 24 months of data collection and all other activities. Is baseline data already collected?
- Two years is reasonable but would be at risk if full year baseline and post monitoring periods are part of the M&V plan.

Cost

Average Score: 2.1875 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Add more specificity on what the CalNEXT will be used for
- $200K may be reasonable.

Feedback

- Cost is high considering the scope to be funded by CalNEXT.
- Unclear what costs will be covered by project. Equipment costs, installation? What costs are the site covering?
- Cost is reasonable but high for typical CalNEXT project range.

Appendix I DAC HTR Statewide SF Housing Characteristics Study

This market characterization study builds on the efforts and findings of the Residential Housing Characteristics Study. Specifically, this study will conduct 400 field surveys of low-income, DAC, and HTR single-family houses, statewide. The results of this expanded field component of housing surveys will serve to validate the results of the census data analysis conducted.

The purpose of the study is to address the lack of complete statewide data on housing structures in disadvantaged communities (DAC) and Hard-to-Reach (HTR) areas, specifically of single-family homes (SFH). While high-level data such as the number of homes in DACs and other key demographic and market information (housing age, access to broadband, etc.) can be obtained from census and other research, data on the baseline physical conditions, current appliances, fuel types and electrical infrastructure found in DAC and HTR homes is lacking (i.e., structural integrity, hazards, electrical panel capacity, wiring technology, and code issues). This data is foundational to being able to both size the total available market for emerging technologies as well as developing effective, properly budgeted program pathways to serve and electrify these communities. Moreover, we aim to assess the electrification readiness levels of the households we survey.

The project will utilize previous study data, leverage IOU ESA programs, contractor networks, CBO, and assessment specialist to perform the data collection. The detailed in-home survey assessments will shed light on how ready homes are for required upgrades, retrofits, minor home repair and remediation needs, which in turn will allow us to, 1) gauge electrification readiness, and 2) refine cost estimates associated with such work. The study will also seek to understand the various barriers / concerns (e.g., how will I cook with my wok on induction), cultural stereotypes (e.g., food won't taste the same on electric/induction), myths (e.g., the power always goes out) and old wives' tales that prevent customers making the switch to all electric in DAC / HTR areas and the overall sentiment and willingness of moving away from gas and other fossil fuels. This will help shape substantiated responses and education pieces designed for these communities and empower them to make informed decisions on electrification, priming and increasing the success of implementing any future programs aimed at electrifying DAC and HTR communities. We estimate the number of Single Family Homes in California where occupants are low-income to be 3.5 M. We plan to survey 400 homes, proportionately distributed by DAC/HTR population densities throughout California, by county.

This information, analyzed in combination with other data, will be used to inform the scope and nature of barriers to serving DAC and HTR communities with Emerging Technologies efforts and to develop programmatic strategies for helping California achieve its decarbonization and equity goals.

Project Details	
Submitter	Ortiz Group
Average score	84.75
Score deviation	3.23
Project ID	1239016165
Technology area	Whole building
Project type	Technology support research
Research type	Market characterization/study

Project Details	
Target market	Residential
Timeframe	12 months
Funding request	Up to $300,000

Evaluation Category	Results
Technology priority maps	No recommendations
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	No recommendations
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	No recommendations
Cost	No recommendations

Criteria

TPM Priority

Average Score: 10 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

Feedback

- Precursor supporting activity for electrification programs.
- Electrical infrastructure is a high priority TPM with CalNEXT role as Lead
- The project plan is directly aligned with electrification, DAC, and HTR priorities.

Technology Transfer and Program Alignment

Average Score: 14.0625 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Identify cost estimating mechanism and partnerships to support the modeling of measures and costs.

Feedback

- The proposed project will provide data that directly support implementation of utility programs for DAC and HTR populations.

Utility and Energy Efficiency Program Benefits

Average Score: 14.0625 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

Feedback

- The proposed project will provide data that will direcly support utility goals around electrification, grid infrastructure, DAC, and HTR populations.

Underserved Benefits

Score: 6 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

- projects will employ disadvantaged workers to perform some of the scope of work
- Project will allow programs to better reach and serve customers in disadvantaged communities

Project Clarity

Average Score: 8.75 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- How will electrification cost estimates be prepared? Who will create the estimates (contractors, project team, use other published cost estimates)?
- Please provide details on project task and organize (order) them into a high level work plan, e.g. develop survey questions, design survey tool, train ESA contractors, evaluate findings, etc.

Feedback

- Need details on project task and organize (order) them into a high level work plan, e.g. develop survey questions, design survey tool, train ESA contractors, evaluate findings, etc.
- The project has a clearly defined scope and expected outcomes.

Project Innovation / Justification

Average Score: 9.375 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• Sample size plan seems to need some adjustment to ensure that variety of housing stock is adequately investigated in smaller counties.

Feedback

• Application states that "While high-level data such as the number of homes in DACs and other key demographic and market information...can be obtained from census and other research, data on the baseline physical conditions, current appliances, fuel types and electrical infrastructure found in DAC and HTR homes is lacking"

• The project plan clearly articulates the gap in the available information specific to DAC and HTR populations, and the need for additional data collection as described.

Project Readiness

Average Score: 7.5 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Identify cost estimating mechanism and partnerships to support the modeling of measures and costs.
Three suggested changes to better ensure relevance of results:
- Alter scope to focus on only some counties that share housing characteristics, allocating the 400 surveys among a smaller number of counties, or
- Alter scope to focus only on one or two housing types. For instance, post-war wood frame or manufactured or pre-war homes, etc, or
- Retain the statewide scope and reallocate surveys from higher population counties to lower population counties

• Please clarify which CBOs, ESA Contractors, TECH Low Income Ambassador Panel Members, Low Income Community Coalition Members, and select CalNEXT partners--if any--that has agreed to support the on site survey effort. Please elaborate on how the CalNEXT funds will benefit the local communities -- will you subcontract and compensate the local ESA contractors to conduct the surveys? Please clarify if/how the on site surveyors will have access to portable tablets and the web-based survey tool.

• I would like to better understand how the overall sampling plan and survey quantity was determined, and how the results will be representative of DAC/HTR throughout the state. The uneven distribution of total population and of DAC/HTR in the state means that some counties will only have 1 home surveyed. I would also be interested in more details on how survey participants will be recruited, how the project team will address any challenges in recruiting participants, and how the team will address barriers to data collection, such as language barriers.

Feedback

• Partnerships for engaging households are identified and well-founded, however there is no clear path toward establishing measure cost based on survey activity.
The number of households that will be surveyed is inadequate to support a statistical assessment of statewide needs. In particular, the regional building construction style and vintage is too varied for the sampling plan.

• Unclear whether the team has already reached out to CBOs and Low Income Community Coalition Members, etc. to gain their buy in. Does not state which specific CBOs or ESA contractors the applications are planning to target.
• The proposal has a clear plan and path to delivery. The text implies that the survey collection tool is an existing resource ready to be deployed. I would like to know more details about the sampling plan and participant recruitment.

Stakeholder Engagement

Average Score: 6.875 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Identify cost estimating mechanism and partnerships to support the modeling of measures and costs.
• Would like to see stakeholder engagement during the development of the survey visits and training of those who will conduct the surveys.
• Please clarify which CBOs, ESA Contractors, TECH Low Income Ambassador Panel Members, Low Income Community Coalition Members, and select CalNEXT partners--if any--that has agreed to support the on site survey effort.
• The project plan could be strengthened with more details about the role of CBOs in the overall project, and if there are specific CBOs that are particularly well-suited to supporting the project.

Feedback

• Partnerships for engaging households are identified and well-founded, however there is no clear path toward establishing measure cost based on survey activity.
• The proposal notes that engaging CBOs is the best pathway for engaging DAC/HTR customers, but does not describe how the project team will engage with the CBOs, or how they expect the CBOs to support participant identification or data collection.

Timeline

Average Score: 4.0625 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

Feedback

• Given the intention to cover all counties and train local staff, scope is ambitious and timline reflects the broad scope.
• It appears that recruitment and training of CBO partners will be needed, in which case 18 months seems more reasonable.
• The 12-month timeframe proposed seems aggressive, but reasonable for the scope as outlined.

Cost

Average Score: 4.0625 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

Feedback

- Feels a little low given the statewide survey. Should expect to oversample by 15% assuming that some homes will refuse to be surveyed or partially completed---or else assume that the final count may be less than the 400 targeted.
- Proposed cost seems very reasonable given the survey sample size and approach.

Appendix J Demonstration of "Combi" Air-to-Water Heat Pump

With increasing scrutiny of global GHG emissions, decarbonizing the building sector is becoming important. Air-to-water heat pumps (AWHPs) have been gaining traction in other parts of the world where hydronic heating predominates, but the current U.S. market is still relatively small. AWHPs work similar to the air-to-air heat pump (AAHP); however, AWHPs have a fully contained and factory-charged refrigerant system in the outdoor unit and use a water-glycol mix to convey heating/cooling to the indoor distribution system (i.e., hydronic fan coils, radiant floors, radiators, radiant ceiling panels, and etc.) and indirect storage tank for domestic hot water (DHW). Most of the current AWHPs in the market utilize low global warming potential (GWP) refrigerants, mainly R-32 and the upcoming ultra-low-GWP refrigerant R-290.

In addition to providing year-round space conditioning, several AWHPs in the market provide dedicated DHW. This “three function” (i.e., space heating + cooling, and DHW) combination operation is attractive as a cost-compression technology because it allows the unit’s high-efficiency variable speed (inverter) to satisfy the building's heating and cooling load efficiently, but it also simplifies installation, avoids costs associated with space constraints, and simplifies electrical service requirements (i.e., majority of retrofit electric distribution is 100A) given that an AWHP would occupy a single circuit on an electrical panel rather than two breakers for a conventional AAHP and a unitary heat pump water heater.

The performance of AWHP "combi" operation is strongly variable as a function of the outdoor ambient conditions, building thermal load, supply temperature, compressor modulation, and system sizing.

The lack of formal rating standards makes rating the seasonal performance for AWHPs for space conditioning and "Combi" systems challenging. The current standards (AHRI 550/590 and ASHRAE 206) and Methods of Test (MOT) are not representative of the state-of-the-art variable speed AWHPs and "Combi" operation. Without standardized testing and MOT with limited laboratory and field evaluation performance data, the ability for utility programs to support manufacturers in these new markets is limited.

We propose to evaluate Daikin's Altherma "Combi" AWHP in both laboratory and field to (1) Develop potential pathways for the adoption of AWHP in California for both hydronic and forced-air retrofit and new build homes; (2) Support MOT development; (3) Develop a Sizing Tool; (4) Generate measures and white papers to support utilities-sponsored programs. The Daikin's Altherma AWHP with a high-efficiency inverter compressor could supply water up to 158°F at a COP > 2, and its space heating capacity ranges from 2.7 to 16.5 kW with heating COP up to 4.8. Multiple units could be coupled to achieve higher heating capacity. The modeled seasonal "Combi" COP is 3.6 for a 2000 sq. ft home in CA Climate 10.

The AWHP will be characterized and modeled in the laboratory to develop performance maps and quantify the estimated energy, cost, and GHG savings compared to baseline technologies. The laboratory testing will be conducted under a load-based virtual test home method (Hardware-in-loop). In the field evaluation, two field demonstrations at single-family homes will be conducted in California's climate zones 7 and 10.

Project Details	
Submitter	GTI Energy
Average score	85.00

Project Details	
Score deviation	6.50
Project ID	1194927979
Technology area	Heating ventilation air conditioning (HVAC)
Project type	Technology support research
Research type	Market characterization/study
Target market	Residential
Timeframe	2 years
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 9.5 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- Part 1 on Laboratory Testing is already funded by CalNEXT via SWEPP-2023-0061. It can't be considered for funding and hence, the proposal needs to be revised and resubmitted.
- For stronger alignment with TPM, it could be good to discuss expectations of 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.

Feedback

- Aligns well with stated TPM category
- Whole Buildings/Integrated Systems - Priority High.
- Its well written and documented proposal
- The proposed project addresses the opportunity of focusing on field validation of high efficiency heat pump performance, and addresses the barriers of standardizing test procedures and addressing oversizing practices with a sizing tool.

• The project clearly addresses key needs identified in the Opportunities and/or Barriers section of at least one, if not two, high priority TPM priority areas; High-Efficiency Heat Pumps for Space Heating & Cooling and Residential-Duty Water Heaters

Technology Transfer and Program Alignment

Average Score: 13.5 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Include numbers on the fraction of CA residential buildings that use hydronic HVAC systems, not just saying that hydronic systems are part of the unclassified systems not covered by other categories. Other non-forced air systems
• The proposal touches on this point but may further elaborate on how incentives could be designed for customer adoption.
• The lack of market awareness is an important potential barrier to the technology and the project plan could benefit from further detail around how the TAC will address this.

Feedback

• Technology is of high interest for savings and scaling in the CA marketplace
• Very few CA residential buildings use hydronic heating, so retrofit costs with ATWHP are likely to be higher than for air to air HP, either separate systems or multi-function heat pump systems. How do ATWHP "Combi" systems compare to air to air Multi-Function HP in terms of equipment and installation costs? Higher costs and or small market would make ATWHP less useful for CA IOU Efficiency Programs. Cost compression is relative to all other electrification options on the market not only to separate ATWHP systems.
• The proposed project clearly defines the technology transfer pathway including development of test standards, and addreses the low market awareness of ASHP for "Combi" operation with formation of a TAC to educate market actors.
• The project is well positioned for integration into a new or existing program and will work to scale the adoption of the project technology in question. The Technology Transfer pathway is clearly outlined and aligns with the Technology Transfer Categories. The project will support and provide strategies and/or recommendations for new utility measures or incentives. The project will also support the formation of an advisory committee which may ultimately assist with the development of additional technology uptake programs.

Utility and Energy Efficiency Program Benefits

Average Score: 12.75 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- It would help to clarify how this will benefit CA utilities specifically (i.e. what will CA utilities be able to do after the research is complete that they cannot do now), recognizing that a uniform testing standard will not be available.
- Is the Daikin Altherma system commercially available in the U? If not, are there announced dates for offering it for sale in the US?

A comparison to air source heat pump options for both space conditioning and water heating is necessary.

- The proposal discusses most benefits except load flexibility and/or grid interaction. These may be addressed with further details.
- If there is any potential load flexibility or grid integration advantage of retrofitting to this technology, it would be helpful to highlight that in the project plan.

Feedback

- Benefit is clear for energy efficiency, but not clear what specific needs of CA utilities will be satisfied.
- Energy savings potential is clear. Cost-compression claim is not supported relative to the air to air systems available on the market including air to air Multi-Function HP.
- The proposed project clearly spells out energy efficiency and reduced cost that positively impacts electrification goals and energy efficiency programs
- The project demonstrates strong benefits to the utilities and related energy efficiency programming. The project will support electrification efforts and the transition away from localized fossil fuel consumption, in-line with State priorities. The project will also work to develop pathways for end-users to reduce energy consumption and demand, with specific emphasis on TSB and LCA.

Underserved Benefits

Score: 10 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Average Score: 7 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Clarify with consistency and explanation the list of outcomes presented in Projet Details and section 20.
- Recommend alignment with NEEA EXP07 load based testing methods (REPORT #E22-328, Variable Speed Heat Pump Product Assessment and Analysis)

Does the Altherma have good controls and EXV combined with a rotary compressor that can unload efficiently?

- It is not clear how the laborator and the in-field testing be conducted, what are the main operating parameters, would the existing systems in field (e.g. Boiler or electric heater) be swiched off while Combi is operating?

• Break this project into two separate projects and submit individually. One project can be for the laboratory phase, the second project can be for the field evaluation phase. Provide additional detail for each scope phase. For example, why and how were the specified climate zones selected? Why evaluate with underfloor heating and hydronic convector cooling in one zone and a centralized forced-air hydronic system in another zone? What climate zones and building stocks will be utilized in the laboratory setting? Why are the specified baseline technologies best for the laboratory setting?

Feedback

• The Project Details section lists four outcomes that are not described in section 20 outcomes.
• Not clear what gaps this project will fill that are not covered by the existing projects on ATWHP in the Central Valley Research Homes by Frontier Energy. Many different activites are planned including lab tests, 2 field tests, technoeconomic analysis, and barriers investigation. How much of this scope are you asking to be funded by CalNEXT? What are the other sources of funding?
The CASE report attached says that most o fthe market for residential hydronic systems is in the Tahoe and foothills and coast. Both sites selected are in very mild climates, it would be good to have one of the sites in the colder CA climate zones.
• Need more clarity overall for better understanding of the testing protocol and the test operating parameters.
• The proposed project clearly identifies outcomes. The timelines and the scope and budget are reasonable considering that Daikin, a critical partner, is supporting the lab testing with an appropriate level of cost share
• The project scope is somewhat clear but not reasonable for single-project implementation. The project scope is broken into two phases, a laboratory phase, and a field evaluation phase, with some detail provided for each. The expected outcomes are generally clear, reasonable, well-developed, and likely achievable. The expected outcomes are also significantly detailed; describing short-term outcome, long-term outcome, final goal, and how outcomes will be achieved.

Project Innovation / Justification

Average Score: 7 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• What are the objectives and details of the specific tests to be performed in in-field testing? Is the objective to test its performance, or market uptake, or standard development or something else?
• Provide additional information, greater detail, and in-depth calculations regarding energy, carbon, or demand reduction estimates. Specifically detail how calculations were made and where assumptions were applied. Provide research as validation.

Feedback

• Differentiation is based on application of technology to CA market. This proposed project appears to have significant overlap with active CalNEXT project Residential Multi-Function Heat Pump Laboratory Testing - ET23SWE0047.
• No cost comparison between ATWHP and Separate ASHP for space conditioning and water heating. If the

• The proposed project includes clear initial estimates for energy savings potential, and clearly spells out a plan to quantify energy and GHG savings.
• The project clearly indicates moderate-to-strong differences from incumbent technologies and/or research and is largely not similar to completed or in progress research projects. Especially with respect to the project's objectives, for example, to support MOT development and develop a sizing tool. Some information is given on energy, carbon, and demand reduction estimates. The project will work to quantify these areas further and includes corresponding calculations, results, and/or research as part of the deliverables.

Project Readiness

Average Score: 9.5 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Must clearly state each objective and deliverable. At the moment most of the tasks and sub-tasks are hidden and lumped into one statement, which is not ideal. What type of control algorithm will be exercised to test its performance in-field to implement three functions with variable speed compressor(s) and fan(s)?
• If could be beneficial to leverage Daikin to find qualified installers of the Altherma system.

Feedback

• Project appears ready for implementation with partnerships and tasks listed in supplemental document.
• The proposed project clearly identifies Daikin as a critical partner, and gives sufficient detail about how the project team will execute the project on time and within budget
• The project has great information about how it will be delivered and has a relatively clear identification of partners. Broad to somewhat detailed descriptions of roles, responsibilities, and how partners will be leveraged/engaged are provided. Collaboration, field install/monitoring, and project tracking is also described. The project clearly demonstrates access and availability to over 100,000 square feet of laboratory testing, evaluation, and prototyping space; significantly boosting project readiness. Information indicates that the project has a strong chance of success.

Stakeholder Engagement

Average Score: 8.5 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Include stakeholder engagement activities in scope.
• The proposal should be received favorably.
• Stakeholders are described relatively well. Consider adding a centralized comprehensive list of stakeholders, and detail further how each stakeholder will be impacted by this work.

Feedback

- Described as engagement with advisory committee. Stakeholder engagement activities not included in scope.
- There is room to improve the proposed project by identifying the key stakeholders who will be educated by the technical advisory committee, especially given the lack of market awareness.
- The project describes who stakeholders will be and how they will be engaged as part of the project effort in an effective manner. Stakeholders will be instrumental in discussing, disseminating, and highlighting the performance and challenges of the technology in question; as well as how uptake can be accelerated. A technical advisory committee will be formed and/or supported by this project.

Timeline

Average Score: 3.75 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- 18 months?
- The project plan would benefit from a clearly defined timeline for lab testing.
- Break this project into two separate projects and submit individually. One project can be for the laboratory phase, the second project can be for the field evaluation phase. Split the proposed timeframe estimate equally between the two individual projects; at least 12 months, but no more than 18 months, for each. This will meet the industry standard timeline of 12-18 months.

Feedback

- includes both laboratory test and fielt test
- The field testing timeline is within industry standard, but the lab testing timeline is not clearly defined. Two years means there should be sufficient time for lab testing
- The project timeframe estimate is not within the industry standard timeline (12-18 months). Given the scope of work, a timeframe of 2 years is generally acceptable, but too long for single-project implementation. With respect to program needs, 12 to 18 months is the target timeline.

Cost

Average Score: 3.5 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- $150K?
- Break this project into two separate projects and submit individually. One project can be for the laboratory phase, the second project can be for the field evaluation phase. Split the proposed budget equally between the two individual projects.

Feedback

- Reasonable for laboratory and field test.
- Budget cap is $300k, please specify what scope you are asking CalNEXT to pay for and revise to under $300k
- Cost seems very high, particularly, when Part 1 can not be funded due to other CalNEXT project studying that aspect at the moment.
- The budget range is reasonable for two field tests and lab testing considering that Daikin, a critical partner, is supporting by donating equipment plus $250,000 for lab testing
- The budget estimate is somewhat realistic but high for single-project implementation. A cost share is identified and quantified. The estimated value per technology unit is also provided.

Appendix K Efficient Elevators Market Characterization Study

The State of California has over 110,000 elevators in service and on average places another 1,000 commercial elevators in service every year. Elevators transport both people and materials within buildings and can contribute 2 to 5% of the annual building energy consumption. Over the past two decades, the elevator industry has seen the introduction of new energy saving technology and has shown early signs of market transformation away from inefficient hydraulic elevators and toward traction elevators and elevators with regenerative drives. The new equipment technology uses less energy, provides greater acceleration and speed and takes less space than the standard technology. The use of incentives and greater outreach to building owners, building designers and elevator designers will bring about a faster transformation and greater energy savings. Since elevators are refurbished about every 25 years and the types of equipment installed at the time of construction can limit choices at refurbishment it is important to bring about the transformation more quickly.

This project will conduct a market study to inform potential intervention points for market support that EE programs could provide to accelerate the adoption of high efficiency elevators. The study will investigate the database of elevators from CA's Division of Occupational Safety and Health (DOSH, formerly CalOSHA) and add market segmentation data to inform what building types are leaders and laggards for high efficiency technology. The study will also investigate total cost, incremental cost, and maintenance cost of different high efficiency options based on surveys and interviews with key market actors and engage existing programs to facilitate faster program uptake. Finally, the study will investigate the prevalence of newer energy efficiency strategies recently outlined in an EU eco-design report on elevators which identified new measures strategies such as deep standby and improved door operations.

With this information utilities can build incentive programs to encourage greater market adoption of traction for the new construction market as well as a retrofit programs to add regenerative drive where practical.

Project Details	
Submitter	Energy Solutions
Average score	58.75
Score deviation	9.76
Project ID	1238984524
Technology area	Process loads (commercial, industrial, agriculture, water)
Project type	Technology support research
Research type	Market characterization/study
Target market	Multifamily
Timeframe	9 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan

Evaluation Category	Results
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 4.2 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• Although this project is presented as an Advanced Motors initiative, stronger alignment is likely found within the Electrical Infrastructure technology area under the Whole Buildings TPM. More specifically, what is needed is a clear and effective answer as to where the captured energy from the proposed regenerative drive system is stored or directed. This is a critical question that can act as a significant elevating factor with respect to CalNEXT program priorities, but it is not addressed in the project description form. Is the regenerated energy/electricity stored to a battery? Is the regenerated energy/electricity pushed back to the building grid, or the larger grid outside of the building? If these features are enabled by this project, then this technology can act as a distributed energy resource (DER) within the subgroup of Direct Current (DC)-Power Systems. This categorization aligns directly with the Electrical Infrastructure technology area, a high priority technology area, within the Whole Buildings TPM. As a DER, this technology has the potential to provide key advantages for opportunities such as Demand Response (DR) and Demand Flexibility. Describe and explain whether these features are feasible, focus this project as a DER as much as possible. Emphasize battery potential, grid interaction potential, and demand response potential. These are high-yield energy efficiency characteristics that are currently central focus areas for utilities in California and across the nation. Primary connection to a high priority technology area

(e.g. Electrical Infrastructure) is required for full credit in this project criteria category. Even still, it is encouraged to maintain a secondary connection of this project to the medium priority Advanced Motors technology area under the Process Loads TPM. To justify this secondary connection, a stronger case for how this project will address advanced motors broadly across all applications (rather than specifically in only elevator applications) is required to fully capitalize on this potentially related technology area.

Feedback

• Intended area of impact is multi-family and commercial buildings, however there is no Technology Research Area within the Whole Buildings TPM to support this project. This project is instead connected to the advanced motors initiative within process loads since the efficient scenario includes a change in motor and drive technology. This project will not address the barriers outlined in the Advanced Motors initiative, but a compelling argument has been made regarding the validity, scalability, energy code, and efficiency program implications.

• Medium priority in TPM, applicable to few buildings

• Due to its focus on elevator efficiency measures specifically, such as traction systems and regenerative drives (and lesser focus on advanced motors technology at large), this project only loosely aligns with the Process Loads TPM, under the Advanced Motors technology area. Advanced Motors is a medium priority technology area. Within Advanced Motors, this project might indirectly help to inform opportunities such as "market research to identify the market share" by investigating motor systems currently found in elevator contexts. In turn, this project may also work to identify new opportunities for retrofit to advanced motors, and may provide education on niche applications where advanced motors may be feasibly deployed. With respect to barriers, this project may help clarify specifically how existing elevator motor equipment packages (a subset of motor packages generally) can be retrofitted, while potentially working to encourage advanced motors, and related efficiency measures, into market sectors that are typically not a main focus point (i.e. elevator motor systems). In addition, this project could potentially provide support in understanding lower priority supply/demand channels for advanced motors and tangentially related equipment such as regenerative drives. It is possible that this project will provide these benefits to the Advanced Motors technology area, but it is difficult to understand if these outcomes will be achieved for certain. More so, it is difficult to understand how these outcomes will address advanced motors in a broader context. That being said, because the Advanced Motors technology family is only medium priority (rather than high priority), because this project appears to be primarily focused on traction, regenerative drive technology, and elevator efficiency measures specifically (rather than on advanced motors broadly), and because this project likely has stronger alignment with a high priority technology area within a different TPM (Electrical Infrastructure; Whole Buildings), only half credit can be given for this project criteria category at this time.

Technology Transfer and Program Alignment

Average Score: 10 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Clearly and specifically identify a Technology Transfer pathway that this project will address from the Technology Transfer categories listed online. Describe in greater detail how this project aligns with the identified pathway. Develop a Technology Transfer plan and specifically describe the steps this project will take to fulfill that plan. Use deliberate language alongside background data to instill confidence in specific Technology Transfer plan steps. Explain in greater detail how the results and data from this project will directly feed into the next steps for a given plan. Attempt to develop a Technology Transfer plan beyond elevator-only use cases and elevator-only new measure package development. For example, if elevator regenerative drives charge back to the grid, or to a battery, discuss how this characteristic can feed into demand response/demand flexibility/DERs and develop Technology Transfer plans around additional Technology Transfer categories such as Case Study Development or Technology/Program Support (e.g. technologies for Integrated Demand Side Management or particular use cases for an integrated demand side management measure). This project may have the potential to address several Technology Transfer categories at once, in the event a larger more comprehensive Technology Transfer plan/roadmap is developed and/or pursued.

Feedback

• The deliverable produced by the proposed study could be used to inform a new measure package to support efficient elevators. The results could also be used by utilities to create new energy efficiency program offerings.

• More information is needed on how this research would inform existing programs

• The project is likely in good position for integration into a new or existing measure package, and may potentially be in position to help scale the adoption of a specific technology (e.g. regenerative drives for elevator applications, efficient traction systems for elevator applications, efficient elevator door technologies, or other elevator-specific technologies). This project may also indirectly influence increased adoption of advanced motors generally, though it is difficult to understand if this indirect influence will be achieved for certain. A gathering of information needed to estimate savings and calculate Total Resource Cost and Total System Benefit, which could ultimately support measure package development, is mentioned. Similarly, a long-term outcome of this project is to enable the addition of elevator specific measures to rebate programs to in turn drive further kWh/kW savings. To ensure this outcome, follow-up measure development and pilot site projects are mentioned and recommended. Although these ideas are cited, they are only stated very generally, and without high confidence. A Technology Transfer pathway is hinted at but not explicitly named, defined, clarified, described, or developed.

Utility and Energy Efficiency Program Benefits

Average Score: 7.5 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Energy efficiency is a good project benefit for the utilities and related energy efficiency programs. However, there is not a profound amount of detail around concepts such as how energy savings will be achieved beyond the high-level mention of different elevator-specific measures. To instill confidence that above-moderate benefits may be achieved, more detail, and a case providing background on how this project might reach beyond elevator-only measures, is required. The most significant question this project begs is what happens to the energy/electricity that is captured by the regenerative drives? If this energy/electricity is pushed back to the grid, or to a battery, then the benefits to the utility and related energy efficiency programs multiply threefold and become highly significant. The inclusion of a battery or some sort of grid interaction opens the door to demand response and load flexibility, in addition to energy savings. The project becomes more akin to a DER study and can transcend beyond an elevator-only application. The opportunity to provide more broad features such as demand shaping would give this project strong benefits for both utilities and related energy efficiency programs. Recommend showcasing these potential aspects of this project as much as possible, above energy savings at the elevator-only level, especially as there is not an elevator specific Technology Area available at this time.

Feedback

• This project has clearly defined benefits for energy efficiency programs, but are limited to kWh savings.

• Programs for new construction is mentioned, but not for existing buildings

• The project mentions a key benefit of significant energy savings and, though briefly, specifically emphasizes Total System Benefits (TSB), kWh/kW savings, and Total Resource Cost (TRC). A rough calculation extrapolating potential energy savings in California from estimated energy savings in Europe is given. Through these details, it can be confidently stated that this project has at least limited-to-moderate benefits to the utilities and related energy efficiency programs. However, given the brief mention of benefits without significant additional detail/description, the relatively limited/specific impact of the project application (elevators only), and the want for more discussion around other potential benefits such as battery storage, load flexibility, demand response, grid interactions, and DERs (with respect to the mention of regenerative drives), it is difficult to confidently assume that this project will provide above-moderate benefits, and to give additional points in this project criteria category at this time.

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

PROJECT IMPROVEMENT SUGGESTIONS

• Proposal states it will investigate the DOSH database of elevators and will add market segmentation data to inform what building types are leaders and laggards for high efficiency technology. We recommend screening the list for DAC using CalEnviroscreen 3.0 tool located here: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30. This might be especially interesting for the elevators serving multi-family buildings.

Project Clarity

Average Score: 6.7 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Provide significantly more detail and organization regarding the scope. For example, how will the database of elevators from DOSH be investigated specifically? What investigative and/or analysis methods will be deployed; models, equations, etc.? What types of market segmentation data will be leveraged? What are the steps to prepare the market segmentation data for integration? What will the criteria be, or how will the criteria be determined, for the leaders and laggards for high efficiency technology? How will surveys and interviews be conducted; what is the format and will there be a questionnaire? How will interviewees be selected and engaged? What newer energy efficiency strategies outlined in the EU Eco-Design report will be investigated for prevalence? Will there be a final report? How will reporting be maintained (e.g. will there be a preliminary report, will there be a draft report, etc.)? Recommend breaking out the scope of work into sub-sections such as "Preliminary Research/Findings", "Analysis of Market Data", "Consolidation of Market Insights", "Draft Report Generation", etc. to provide a more organized level of detail. This same level of detail can be generally applied to the Expected Outcomes section as well, in order to achieve a full points score for this project criteria.

Feedback

• The scope and expected outcomes from the proposed project are obvious, reasonable, and achievable.

• Unclear how outcomes will inform standards development

• The project has a somewhat clear scope and a generally clear set of expected outcomes that are likely achievable. Having expected outcomes broken into short-term and long-term categories is helpful. Although it is not explicitly stated, it is assumed that this project will culminate in a final report, delivered to the CalNEXT program. Similarly, although an evaluation of potential energy

savings is not explicitly detailed in the scope section of the project intake form, savings data is mentioned as an expected project outcome.

Project Innovation / Justification

Average Score: 8.3 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide more explicit calculations, or at the least, clarify descriptions of calculations that will be required to quantitatively analyze this project. Provide descriptions of key variables. Provide additional background, for example, how exactly is energy saved with particular elevator efficiency measures? What does a traction system do that makes it more efficient, and how does that impact the motor system? Where does energy/electricity captured by a regenerative drive go? Is there a reach for this project/technology that goes beyond elevators? Provide carbon reduction estimates and/or calculations. Detail energy and demand reduction estimates and/or calculations further. If calculations and estimates are unable to be made, provide closer detail on how this project's research will facilitate estimates and calculations. To elevate this project's innovation/justification (and if applicable), describe how a regenerative drive might integrate with a battery system to provide demand response and load flexibility; or act as a DER. Further estimates and calculations could be made in this regard as well.

Feedback

• This project identifies clear differentiators from incumbent technology. Estimated energy savings are provided, based on an EU study that is scaled for the California market.

• The project indicates moderate to strong differences from incumbent technologies and/or research due to its specific application to elevator systems and elevator efficiency measures. The project does not appear to be similar to any completed or in progress research and appears to be relatively unique for CalNEXT. Limited information on energy and demand reduction is provided. No information appears to be provided regarding carbon reduction. Relevant quantitative estimates, background data, and light calculations are described and explicitly written out. Further energy savings analyses and similar calculations are included as part of this project's research objectives. Overall, this project appears somewhat innovative, but with a justification that can be considerably strengthened.

Project Readiness

Average Score: 8.3 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide more detail with respect to the project delivery pathway. For example, what are the key milestones or stages required for successful project delivery? Provide a list with short descriptions at each milestone/stage (e.g. Market Research, Interview Research, Draft Report Generation, Data Analysis, etc.). How much time will be allotted between each milestone/stage? Provide more detail on exactly what project partners will do, and when they will do it. What are the different roles between partners? What kinds of titles are expected to be involved in project delivery (e.g. design engineer, project manager, building operator, data analyst, etc.)? How will collaboration occur? Will there be meetings; how often will meetings occur? Etc.

Feedback

• This project identifies a clear path to completion and leverages critical partners, providing confidence that this project will be completed on time and in budget.

• No information about capabilities for collecting and analyzing qualitative market data

• The project has generally good information about how it will be delivered and has clearly identified partners and/or partner organizations. Information provided indicates that the project has a suitable foundation of industry professionals and thus should have no major issues achieving success.

Stakeholder Engagement

Average Score: 7.5 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Participation from stakeholders will be critical to the successful and timely completion of this project. Providing a plan that describes why stakeholders would choose to participate in the interviews would strengthen this project proposal.

• Create a comprehensive and more granular list of stakeholders and clearly state stakeholder titles, how stakeholder titles will engage in supporting project outcomes, and how stakeholder teams will coordinate (i.e. a detailed step-wise plan for how stakeholders will be engaged). Define responsibilities by both organization and individual title as much as possible. Relate the stakeholder list to the different project objectives, deliverables, and milestones/stages.

Feedback

• Project proposal describes who the stakeholders will be and how they will be engaged.

• The project clearly states who the key stakeholders are and/or might be and provides adequate general details on how stakeholders will engage in supporting the project objectives.

Timeline

Average Score: 3.3 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

• Recruit additional partners/support to achieve project outcomes and deliverables within the industry standard timeline of 6 months. Or, broaden the scope of work to include elements such as a feasibility study or preliminary design work for the technology in question. For example, if preliminary designs of traction system/regenerative drive configurations can be created by participating design engineers, and this aspect can then be folded into a feasibility study framework, this scope adjustment could justify a 9 month timeline. This would award 75% of points in this project criteria category. If a market characterization study can be achieved in <6 months time, or a market characterization study with feasibility elements can be achieved in <9 months time (and the improved timeframe is well-demonstrated in the project intake form) then this project criteria category will be exceeded and 100% full credit will be granted. Regardless, do not compromise project quality.

Feedback

• The project timeframe estimates are within industry standard timeline given the scope and expected outcomes.

• The industry standard timeline for a market characterization study is roughly 6 months. At 9 months of time, and given the scope of work, this project's timeframe estimate is close to being within the industry standard, but just slightly longer than desired.

Cost

Average Score: 2.9 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

• Develop and identify a cost share with a partner, manufacturer, or other outside entity. Describe in specific detail where higher costs may come from. Provide justification for why a market characterization study without any feasibility/design work requires $200k in funding, rather than a more typical amount between $125k-$150k. Investigate specific strategies that allow for reductions in project cost and document them more clearly to demonstrate a strong commitment to the effective use of CalNEXT funding.

Feedback

• The budget is realistic for the proposed scope and outcome.

• The project budget estimate may be realistic but feels significantly high, and is higher than expected relative to the project scope/outcomes. Market characterization studies are typically expected to come in around $125k-$150k. For market characterization studies that include exceptionally large scopes of work, or include feasibility aspects such as preliminary design work, budgets greater than $150k (and at $200k) are appropriate. Because this market characterization study does not include an exceptionally large scope, nor any significant feasibility/design work, $200k appears high, and only half credit can be given for this project criteria category at this time.

Appendix L Electrifying Large Commercial + Thermal Storage: Demonstration of TIER and Program Delivery Implications

The rapid push for decarbonizing all buildings presents significant challenges for large commercial buildings. Standard designs for large commercial buildings rely on separate gas-fired hydronic heating and chilled water loops, which have slowly been refined with incremental efficiency improvements over several decades. Industry has not yet had enough time to establish how to serve large commercial building heating loads effectively and efficiently with all-electric equipment. Many engineers lack the expertise and time to keep up with new and rapidly evolving equipment and to overcome the novel design challenges to combine the plant equipment into functional systems. To meet the urgent need to rapidly decarbonize buildings, the industry needs targeted support to overcome these new design challenges and barriers around system complexity and integration.

The first generation of all-electric large buildings has relied upon air-to-water heat pumps (AWHP), an approach that has had difficulty meeting design objectives and is cost prohibitive for most building owners. AWHPs are inherently inefficient during cold weather, have limited operating ranges, and have a large footprint (making that approach infeasible for existing buildings). Heat recovery chillers can operate at higher efficiencies to generate both hot and chilled water but only when simultaneous heating and cooling loads are available. Many early projects have struggled with misapplication of new equipment and critical design oversights.

Time independent energy recovery (TIER) is a revolutionary all-electric heating and cooling plant concept that integrates heat recovery chillers, thermal energy storage (TES), and AWHPs to overcome the shortcomings of alternative all-electric plant configurations. Traditional TES is used to shift or reduce peak cooling loads, whereas TIER leverages TES for heat recovery. The result is a cascading all-electric system that maximizes heat recovery and smartly deploys the plant equipment to maintain highest system efficiencies.

Though TES can have large space requirements, when sized appropriately in a TIER plant, the heat recovered in storage allows for dramatic reductions in required AWHP capacity, significantly reducing plant footprint and first cost. In California's mild climates, the energy recovered from cooling loads alone can satisfy heating loads for most of the year. The AWHPs only operate when needed and to an intermediate temperature, which allows for higher efficiencies. Overall, the TIER design saves space, improves efficiency, supports grid-interactive efficient building initiatives, and reduces costs.

Each of the equipment types in a TIER plant are commercially available, however, the proper design and control of the built-up central plants is complex and challenging to implement. The purpose of this project is to unravel the physics and operational characteristics of a TIER system. This project will leverage an in-depth performance review of the first-of-its-kind TIER plant that is currently under construction for a new 300,000 ft2 building and expected to begin operation in early 2024. We will demonstrate the benefits of the concept and develop resources for supporting broader application and technology transfer, including a case study, design guide, and recommendations for utility program design.

Project Details	
Submitter	Taylor Engineers
Project ID	1195239766
Technology area	Heating ventilation air conditioning (HVAC)

Project Details	
Project type	Technology support research
Research type	Field demonstration
Target markets	Commercial
Timeframe	2 years
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	No recommendations
Technology transfer and program alignment	No recommendations
Utility benefits	No recommendations
Underserved benefits	Project not a good fit to provide DAC/HTR benefits
Project clarity	No recommendations
Project innovation/justification	Project improvement suggestions
Project readiness	No recommendations
Stakeholder engagement	No recommendations
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

Feedback

• Excellent alignment with multiple 2023 Technology Research Areas within the HVAC technology category. I see this proposal project aligning with High Eff HVAC Heat Pumps, Scalable HVAC Controls Development, Heat pump market development, HVAC design for decarbonization, scalable thermal storage, and Installation Operations & Maintenance.

• HVAC/Scalable Thermal Storage - Priority: Medium

• The project aligns with HVAC Design for Decarbonization

Technology Transfer and Program Alignment

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

Feedback

- The project as proposed will provide critical data and resources for utilities, that can be used to support customer adoption and inform how portfolios can claim savings. It is a benefit that all components of the system exist readily in the market and are commercially available.
- Case study & design guide development

Utility and Energy Efficiency Program Benefits

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

Feedback

- Fully decarbonized (fossil fuel free) heating for large commercial buildings, integration of TES that can potentially be used to shift peak use, improved energy efficiency of the all electric heating and cooling when compared to other more typically discussed technologies.
- "TIER is estimated to provide energy savings of 40 percent compared to the current state of-the art all electric central plants". Mention of improving energy efficiency in the business case section needs to also be said in the project description and utility benefits sections.
- The project has clear benefits to electrification

Underserved Benefits

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

- 1. Project seeks to "unravel" the physics and operational characteristics of a TIER system -- in part by leveraging an in depth performance review of the first of its kind TIER plant that is currently under construction for a new 300,000 ft2 building and expected to begin operation in early 2024. -- Is the location of this site known? is it in a DAC or HTR? 2. In the long term, the outcomes of the project may benefit large commercial properties located in DAC/HTR (and thereby the community).

However, in the short term, is there any plan to include community stakeholders on the benefits of the project's long term goals to reduce first cost and improve energy efficiency compare to other approaches? Consider broadening the list of key stakeholders. Although DAC/HTR may realize benefits in the very long term, it's unclear how the project itself (in the immediate time frame) benefits DAC/HTR areas.

Project Clarity

Category Description – Project has clear scope and expected outcomes

Feedback

• Unclear if the project is asking for funding to do the field demonstration, monitor the field demonstration, or analyze the data from an existing field demonstration.

• Task 1. performance review of the field demonstration is valuable. The proposed task includes a comparison against alternative designs to validate the efficiency of the demonstration site, which is vague in terms of scope and method. Suggest adding some specifics about the plan for the comparison analysis. Task 2 proposed a design guide. Documenting lessons learned might be more reasonable scope, as the scope for design guide is a bit ambitious with data based on one design case. The proposed Task 3 Market Development includes outreach to manufacturers to encourage development of packaged solutions. The project might benefit from a market discovery assessment to assess whether the packaged solution is indeed needed and practical for large commercial buildings. engagement could be expanded to more market actors such as designers and contractors.

• The scope and deliverables are clear

Project Innovation / Justification

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

Feedback

• Energy efficiency estimates are provided comparing the project HVAC system to a more typical heat pump system. The carbon reduction is the ability to serve a large commercial building's hydronic distribution to AHUs with out any fossil fuel.

• TES is an old technology, but TIER is used in innovative way in combination with HPs and presents to be one of the critical elements in electrifying large buildings

Project Readiness

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

Feedback

- Test case system and building are already underway and will be complete in early 2024 for testing and research on optimization and metering.
- Has the field demonstration site been identified? And is there a commitment form the building owner to pay for the installation with full financing or other funding sources?
- Task delivery approach could be improved to show project readiness. Similar comment as to Project Clarity, some proposed scope seem ambitious with limited data and the proposed timeframe
- The project already has a site

Stakeholder Engagement

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

Feedback

- It is noted that the submitter will partner with Energy Solutions and leverage experience on past building research projects.
- The proposed Maket Development task include outreach to manufacturers to encourage development of packaged solutions. The project would benefit from a market discovery assessment to justify the packaged solution is indeed the solution for large commercial buildings.
- The project scope includes developing utility program recommendations by consulting various key stakeholders.

Timeline

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Consider 18 months

Feedback

- Likely to require 24 months +
- Finishing field demonstration, design guide and program design in proposed 2 years seems optimistic
- 2 years seems a little long but the scope includes many tasks that might require the entire duration

Cost

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Specify if the project cost includes equipment cost.

Feedback

- Capped at $300k
- Cost is reasonable
- It is on the higher side if it does not include technology incentive

Appendix M Enabling Non-Residential Electrification and Efficiency with Fault Managed Power Systems (FMPS)

This project will explore market potential and assess how fault-managed power (Fault Managed Power) can reduce the barriers to electrification efforts by reducing the complexity and cost of electrical infrastructure upgrades across non-residential (commercial, industrial, and agricultural) customer segments. The project will investigate the potential of Fault Managed Power Systems and applications commercially available and in use at buildings in California. The project consists of a market assessment, a focused pilot, and a technology roadmap.

This project will explore the Fault Managed Power market potential and associated individual technologies to better understand the landscape and program impacts and scale the market. With the rising need for widespread electrification of buildings in California, innovative solutions are needed to support broad decarbonization efforts. The project will investigate emerging Fault Managed Power technology and vet the systems for commercial, industrial, and agricultural applications. The market assessment will investigate the percentage of buildings using Fault Managed Power Systems, market penetration of technology, and energy savings potential for increased adoption of Fault Managed Power technology. The assessment will leverage literature review, surveys, interviews with experienced practitioners, and site visits to assess potential for energy efficient technologies that can achieve significant energy savings in new and existing buildings.

The focused pilot will improve the ability of the emerging Fault Managed Power technologies to generate demand reductions and energy savings and to support new measures eligible for energy efficiency programs. Fault Managed Power technology capitalizes on providing DC power to DC-powered devices, reducing line losses over long distances via efficient power delivery, and provides simpler, lower-cost electrical infrastructure that enables the electrification of space heating, water heating, foodservice, and electric vehicle charging infrastructure and energy savings through high-efficiency power distribution and flexible demand management.

FMPS reduces barriers to installing new electrical distribution by lowering cost and complexity of installing new power distribution. Cities do not have enough physical space to add more power distribution for electrification projects. FMPS uses an entirely separate pathway (communication cable) to overcome space constraints.

This technology will be assessed to examine the range of products currently on the market, the current state of advancement of the technologies, and how they can be integrated within existing programs. The pilot will deploy and study Fault Managed Power technology to power at least one HVAC, water heating, or electric vehicle charging system of two non-residential buildings to calibrate the findings of the market assessment and inform the technology roadmap.

The technology roadmap will assess Fault Managed Power technologies for further field assessments, pilots, work paper development, and go to market strategies for existing program channels. The roadmap will be produced based on an in-depth analysis of the highest potential technologies to identify market barriers and intervention strategies to address these barriers.

The project deliverables will identify cost-effective energy efficiency measures (FMPS hardware like circuits, switches, transmitters, and receivers) for FMPS infrastructure in the non-residential sectors and present a road map to integration into program offerings, including needs for new or updated measure packages.

Project Details	
Submitter	Energy Resource Integration
Project ID	1189763157
Technology area	Whole building
Project type	Technology support research
Research type	Field demonstration
Target market	Commercial
Timeframe	18 months
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	No recommendations
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	No recommendations
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- Aligns well with Whole Buildings, Electrical Infrastructure priority

Feedback

• Project Is aligned with the Electrical Infrastructure section of the Whole Buildings technology family, which is identifed as a lead role and high priority. The project directly addresses key needs identified in the “Opportunities” by potentially improving cost-effectiveness in deploying electrical infrastructure. Project directly addresses “Barriers” section addressing lack of program integration to combine enabling technology with electrification.

• FMPS is not explicitly mentioned in the Whole Buildings TPM but is a newly emerged commercial solution that can complement the measures noted in the TPM such as smart panels.

• Project directly addresses key needs identified in the “Opportunities” or “Barriers” section of the 'Whole Buildings' TPM under the Electrical Infrastructure high priority reserach area.

Technology Transfer and Program Alignment

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

Feedback

• Project is well positioned for integration into a new or existing program, by both supporting new custom measure development and can lower the barriers to existing program measures. Technology Transfer pathway is broadly described but is not clear and specific.

• Applicants mention incentive and program design recommendations for FMPS as a new measure and proposes to provide measure study and recommendations.

• It is unclear how FPMS could integrate with utility programs. They have scope (Technology Roadmap in Task 7) to help define this, but it's not certain what their outcome will be.

• Project is well positioned for integration into a new or existing program, or to scale the adoption of a technology. Technology Transfer pathway is broadly described but likely aligns with Technology/Program Support

Utility and Energy Efficiency Program Benefits

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide more detail how FPMS could provide demand management.

Feedback

• Project has strong benefits to the utilities and energy efficiency programs by enabling electrification, energy efficie3ncy and flexible demand management.

• Utility benefits listed include enabling grid interactive efficient buildings by receiving grid signals and intelligently manage loads. This is a novel measure that could offer opportunity for a completely new EE program.

• Proposal states flexible demand management as a benefit, but doesn't describe how or if building loads/needs could still be met or how FPMS would be integrated with end-use equipment.

• Project has moderate benefits to the utilities and energy efficiency programs.

Underserved Benefits

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Before approving, the project should commit to a set number of completed surveys, not just submitted surveys.

• Description of task 6 focused pilot needs to clarify scope of the installation if it will be throughout the building, in a part of the building, if it will focus on enabling electrification of water heating, electric vehicle or other specific measures. Discuss how energy savings are achieved in a building with FMPS enables electrification (converting measures from gas to electric and adding more electric measures). I had to do a bunch or reading outside the application and it appears that the main energy savings come from reduced line losses. Please write out acronyms when they are used for the first time, like "CEA".

Feedback

• Scope and expected outcomes are obvious, reasonable, and achievable.

• The project scope is well defined but due to breadth the inherent dependencies introduce risk.

• Description of the survey and market assessment is fairly clear. Description of task 6 focused pilot needs to clarify scope of the installation if it will be throughout the building, in a part of the building, if it will focus on enabling electrification of water heating, electric vehicle or other measures. Project mentions that energy savings are achieved in a building with FMPS enables electrification (converting measures from gas to electric and adding more electric measures) but the mechanism of how a thinner wire that can carry more power saves energy is unclear to me.

New electric appliances wouldn't consume less energy just because it's hooked up to a thinner wire. I Needs to spell out acronyms when they are used for the first time, like "CEA".

- Clear scope, just very ambitious.
- Scope and expected outcomes are generally clear, reasonable, and achievable.

Project Innovation / Justification

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- See comments above. In addition, what is the mechanism for reducing demand, are you talking about leveling consumption to avoid demand spikes, or reducing total demand for power overall?
- Additional details about energy efficiency estimates for the project site may be needed.

Feedback

- Project indicates strong differences from incumbent technology and/or research and is not similar to completed or in progress research projects. It has limited information on energy, carbon, or demand reduction estimates but includes some calculations and research on this as part of the project.
- strong differences from incumbent technology and/or research and is not similar to completed or in progress research projects. Limited information on energy, carbon, or demand reduction estimates - it wasn't clear how each assumption listed used in the estimate are relevant (Why did they pick City of Palo Alto to estimate floor area per person? How is that used in the estimate?).
- Project indicates moderate differences from incumbent technologies and/or research and is not similar to completed or in progress research projects. It has limited information on energy, carbon, or demand reduction estimates but has this research as part of the project.

Project Readiness

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

Feedback

• The Project has great information about how it will be delivered and has identified partners. Information indicates that the project has strong chance of success within the estimated budget and timeframe.

• The field study task seems too short to effectively quantify all the claims

• Application identifies partners, there is a lot being crammed into the proposal in 18 months that makes likelihood of success to be moderate to good.

• Great team of necessary collaborators already identified/secured.

• The Project has good information about how it will be delivered and has identified partners. Information indicates that the project has good chance of success within the estimated budget and timeframe.

Stakeholder Engagement

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Clarify which if any of the partners noted in the application is committed or signed on to this project.

• State stakeholder types to be surveyed and how respondents will be identified. Consider including utility program managers in interviews.

Feedback

• Project has a comprehensive list of stakeholders, how the stakeholders are impacted by this work, and a plan for how they will be engaged during the project.

• Project should include more details about specific utility program engagement

• Application identifies partners and describes their role. It's not clear which if any of these partners is already committed or signed on to this project.

• Proposal noted surveys of 800+ people but didn't state the type of stakeholders with whom the survey would be conducted and how survey respondents would be identified.

• Project describes who stakeholders might be and how they will identify and engage stakeholders as part of the project.

Timeline

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Consider lengthening project.

Feedback

- Project timeframe estimates are within industry standard timeline given the scope of a market study, focused pilot, and technology roadmap.
- there is a lot being crammed into the proposal in 18 months. I think 2 years is more reasonable.
- Seems short given the very ambitious scope, particularly because there is a field pilot component with no sites identified yet. Consider lengthening project
- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes.

Cost

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Should be clear if incentives to the sites visits and focused pilots are included.

Feedback

- Budget estimate is somewhat realistic but higher than expected and relative to scope/outcomes. Survey could be automated and delivered at low cost. Four site visits and two buildings in the focused pilots has limited in-field work.
- With this technology being very new I expected the cost to be on the higher end. No cost share identified
- Budget estimates are realistic and aligned with the program expectation.

Appendix N Field demonstration of electric clothes dryer controller

The proposed project is field demonstration of electric clothes dryer controller that can be added onto existing an electric dryer. Previous studies have shown that clothes dryers operate longer than needed even in automatic termination mode, wasting energy and drying time. The proposed technology consists of duct adapter, temperature and humidity sensor, and controller and can be installed easily without tampering with existing power or dryer wiring. The sensor in the duct detects the temperature and humidity in the dryer exhaust air stream and turns off the dryer when the exhaust air reaches an optimal level of dryness, the controller turns off the dryer.
Previous testing was conducted using the DOE's test procedures on four different electric dryer models, resulting in 15-20% estimated annual energy savings. With this project, we are going to evaluate the energy saving of the product in the field, in residential homes. The field testing will supplement the previous test with a broader and more comprehensive dataset, allowing us to refine energy savings estimates in the real-world applications. Additionally, we will conduct a survey to collect information on participants' user experiences.

Project Details	
Submitter	AESC
Average score	63.25
Score deviation	5.10
Project ID	1239073416
Technology area	Plug load and appliances
Project type	Technology support research
Research type	Field demonstration
Target market	Residential
Timeframe	12 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	No recommendations
Technology transfer and program alignment	No recommendations
Utility benefits	Project improvement suggestions
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions

Evaluation Category	Results
Stakeholder engagement	No recommendations
Timeline	No recommendations
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 7.5 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

Feedback

- Project aligns with TPM, but is not a Lead category.
- Medium priority on TPM
- This project falls under the Household Appliances TPM but has a medium priority level.
- TPM alignment is good

Technology Transfer and Program Alignment

Average Score: 11.25 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

Feedback

- Project is well positioned for integration into a new or existing program. Tech transfer pathway is described.
- Uncertainty in technical maturity.
- Not sure if this device would save 20% on a new dryer. Newer dryers have improved built-in moisture sensing. At a consumer cost of $149.99 plus installation which could be over $100.00, not sure how many dryer consumers would spend that much money to save energy.
- Eventually could become a deemed measure

Utility and Energy Efficiency Program Benefits

Average Score: 11.25 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- I'd recommend including information related to the total available market, and how these savings may contribute to market-side energy use. For instance: Is this product applicable to all dryers, or just electric? How may are there? How much energy does a typical electric dryer use (kWh and kW)? Based on that information, how would this product reduce energy consumption and demand (at the household, or total building level).
- Explain how you have overcome past issues in current product.

Feedback

- Though the proposal cites savings "up to 20%," it is unclear how these savings translate to the total market.
- Uncertainty in technical maturity and long-term savings.
- Saves energy

Underserved Benefits

Score: 2 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

PROJECT IMPROVEMENT SUGGESTIONS

- Proposal states it will try to locate the test sites in DAC and HTR communities, possibly including mobile home parks. We recommend using CalEnviroscreen 3.0 tool located here: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30 to help with identifying DAC areas for study participation.

Project Clarity

Average Score: 6.25 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- How many sites? Will one month of monitoring capture enough data?
- Rethink the approach to the project to avoid duplication of previous work. Focus on extending the Ecos result, not replicating it.

Feedback

- Scope and expected outcomes are generally clear, reasonable, and achievable.
- Project scope was clear and concise.
- The project is not well-scoped. The market study is already complete. The field demonstration is already complete. What is needed is a scaled field deployment. As many installations as possible to verify and extend the results of the Ecos study using a wider data set.

Project Innovation / Justification

Average Score: 5.625 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- Are there other products available in this space? RH sensors are notorious for drift and calibration issues. How does this product address those know deficiencies?

Feedback

- Submittal indicates moderate to strong differentiation related to incumbents. Submittal provides some information and calculations related to energy reduction.
- Most dryers today use sensing. This product would possibly enhance dry times but mostly on older dryers.
- The proposed work is justified. But the differentiation from previous work would be clearer with the scope modifications suggested above.

Project Readiness

Average Score: 6.875 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

- I'd recommend adding detail to explain how things will be done, and what experience the project team has completing similar tasks.
- Have the improvements called out in previous test report been implemented?

Feedback

- The proposal includes a scope for the activities which will be performed, and the anticipated outcomes. But, the proposal does not include much detail on how things will be done, and the team's experience performing related work (such as stakeholder engagement).

Stakeholder Engagement

Average Score: 5.625 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

Feedback

- Project lists potential stakeholders, but does not include much information on how and when they will be engaged..

Timeline

Average Score: 3.75 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

Feedback

- Project timing seems within industry standard.

• With the current review and approval cycles, stakeholder feedback, and reporting requirements, 12 months is ambitious. 18-months is more likely in reality.

Cost

Average Score: 3.125 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

• Missing a target range and minimum number of demo sites to support budget requested

Feedback

• Budget seems realistic and achievable. No cost share.

• Impossible to evaluate the cost until the scope is re-worked.

Appendix O Harvesting Mid-size Industrial BRO Savings

Current CPUC regulations limit the use of Normalized Metered Energy Consumption (NMEC) as a savings platform to three use cases: commercial buildings, industrial sites enrolled in a Strategic Energy Management (SEM) program, and industrial sites with "commercial-like" building loads approved on a case-by-case basis. For the latter use case, Site-Level NMEC allows large industrial customers with eligible building-like loads to pursue custom behavioral, operations and maintenance (BRO) projects and determine savings based on a normalization model. This project would establish the data to prove the robustness of a fourth use case: NMEC within industrial sites (with particular attention to smaller and midsize sites), including their process loads (not just building-like loads) outside of an SEM program. In California today, no program design exists to cost-effectively capture comprehensive savings from the Small and Medium Business (SMB) industrial customer segment. This pilot aims to prove the viability of NMEC in this setting, demonstrating it is a robust, cost-effective way to claim energy savings at midsize industrial sites. Midsize industrial customers have historically been underrepresented in energy efficiency programs because of a lack of available savings pathways under current California regulations.

In this pilot, we will recruit three to four midsize industrial customers within PG&E territory to participate, conduct two- to three-day onsite tune-ups (retro-commissioning events) with each site, and build each site an energy regression model to capture BRO savings opportunities identified during the tune-ups. Midsize industrial customers frequently lack the staffing to support engagement in a full, two-year SEM program nor do they have sufficiently high annual usage to cost-effectively justify submitting multiple projects through the custom platform. Through this pilot, we aim to show the viability of using the NMEC platform and measurement and verification (M&V) methodology to engage these sites in a way that meets their needs: it will streamline the program engagement requirement and the pathway to claim and earn incentives for energy savings. Focusing first on low- and no-cost BRO measures eliminates a common budgetary barrier for SMB industrial customers in California. This approach yields them quick cost savings and builds enthusiasm for additional energy projects.

If successful, this pilot would open an important new avenue for all of the electric IOUs in California to claim more energy savings in the near-term through their industrial energy efficiency programs at a time when cost-effective energy efficiency is increasingly difficult to come by. Using regression modeling to capture multiple concurrent energy efficiency projects within an industrial site is a proven methodology. It also allows customers to move forward confidently with projects knowing they will earn incentives based on their site model rather than needing to move through a time-consuming, complicated custom project review process for each individual project they undertake through a utility program.

Project Details	
Submitter	Cascade Energy, Inc.
Project ID	1195219623
Technology area	Process loads (commercial, industrial, agriculture, water)
Project type	Technology support research
Research type	Measure development enhancement

Project Details	
Target market	Industrial
Timeframe	18 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	No recommendations
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- Could use more specificity; unclear as to scope. There is a mention of specific TPMs, but would like to see specifics of the application of this proposal to those TPMs.
- Providing direct examples of how the project aligns with the priority areas would help improve this category.

Feedback

- Project has implication for multiple Technology Research Areas. Most notably, it addresses a barrier identified in Smart Manufacturing and Controls (use of NMEC for savings quantification).
- industrial process loads - priority medium

- Proposal broadly aligns with process load TPMs, but is too nebulous.
- Project partially aligns with several medium TPM priority areas and project gives. However, the Project does not aim provide direct key insight on the opportunities and barriers outlined in the mentioned TMP. Clear reasoning was provided as to why the project should be approved through this program.

Technology Transfer and Program Alignment

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

Feedback

- Project will use the outcome of four case studies to recommend an expansion of the NMEC savings pathway already used by IOU's to include underserved small and medium-sized industrials.
- Clear motivation from gap in EE programs
- Proposes to take NMEC to customers that currently do not qualify due to cost restrictions, SEM requirements, or existing program requirements. This is an expansion of existing programs.
- The project is well positioned for integration into existing EE/DSM portfolios if current regulations around the project type changes.

Utility and Energy Efficiency Program Benefits

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Is a forecast possible, of either the expanded number of customers as a result of a successful program, or of the expected energy savings?

Feedback

- Project would directly benefit utilities with enhanced low cost EE savings opportunities and possible load flexibility identification.
- Large EE opportunity
- Expansion of the customer base for optimization programs is a great benefit, and the proposal makes mention of the lack of programs for small and midsize industrial customers, but does not offer a clear picture of the expected outcomes in terms of GHG reduction or energy savings

• If successfully demonstrated, utility would be able to claim significant savings from applicable measures from the industrial sectors

• The project would result in the data needed to determine cost effectiveness of BRO measures in Industrial NMEC for SMB customers.

Underserved Benefits

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Unclear which variables will need to be normalized besides weather, and what impacts that may have on the outcome, budget, and timeline for the project.

• How are savings opportunities for each site identified? How are savings measured?

• I suggest adding more detail around demonstrating the cost effectiveness and viability of the proposed project.

Feedback

• Project seeks to address low interest and/or participation from small and medium industrials in energy saving programs, especially those in HTR's and DAC's.

• Expected outcomes are clear, but the method and scope is not so clear.

• Project scope need to clarify how to assess the applicability and success of NMEC method when applied to industry BRO measures.

• Short term and long term outcomes are presented, but lacks detail.

Project Innovation / Justification

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- Because this is seeking to expand existing program offerings, there needs to be made clear the expected cost and benefits of this expansion, which is spoken only in nebulous terms in the proposal.
- Suggest provide estimation of impact on energy saving potential. Identify example BRO measures and the size of market

Feedback

- Project is based on expanding the existing NMEC savings pathway for additional groups of customers.
- Clear strategy to address EE programs gaps
- The barriers for SMB to participate in current IOU offerings for SEM and NMEC is clearly stated, but still unclear as to how this program would help offset the barriers if customers lack internal resources or energy usage to pursue SEM programs.
- The project suggested using NMEC to different use cases. It could potentially expand the program offerings if successful.
- Project identifies differentiators from currently allowed programs and EE potential.

Project Readiness

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

- What projects were implemented in Washington, and what were the savings outcomes?

Feedback

- Potential partners have been identified. Project has strong chance of success within the estimated budget and timeline.
- A variant of this proposal seems to have been implemented with Puget Sound Energy, but no further details are provided.
- Not sites have to identified, but have a plan to identify site
- Project gives an 18 month timeline.

Stakeholder Engagement

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Would like greater clarification on how the third customer site would be identified and evaluated as a potential candidate, and of the two already identified, what sectors they serve and which TPMs would most likely apply.
- Please include plan to engage with stakeholder to improve NMEC rulebook

Feedback

- Proposal could be strengthened by indicating how critical stakeholders such as the IOU's or CPUC would be engaged throughout the course of the project.
- Two potential sites already identified, with a third not yet defined.
- Project provides sufficient information on stakeholder engagement.

Timeline

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Would like to see major milestones within the 18 months. What's the time expected to establish a baseline, identify improvement areas, and measure savings after implementation?

Feedback

- Timeline is appropriate to capture seasonal influences and production fluctuations.
- Project timeline is given as 18 months, with no other details.
- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes.

Cost

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Is this covering the engineers who will be on-site running the program, materials, etc?

Feedback

- Cost is a bit higher than expected considering there
- They ask for 200,000 without explaining what that is covering.
- Budget estimates are realistic and aligned with the program expectation.

Appendix P HVAC Thermal Energy Storage System for VAV boxes

The technology to be studied is Stasis Energy Group's Thermal Energy Storage System (TESS) that utilizes fire rated PCM integrated into VAV boxes. The TESS shifts the HVAC energy by charging the thermal storage media during off-peak hours. The TESS is actively managed to get the maximum cooling benefit and cycling of the thermal storage media during the peak This project is aimed to demonstrate our new technology in medium-size facilities from 20,000 – 100,000 SF, which utilize terminal variable air volume (VAV) boxes to provide zone cooling.

Previous lab and field studies, including current CalNEXT study (ET23SWE0022), have demonstrated in-duct TESS's capability to shift and reduce peak load of a single-zone constant-volume RTUs. With the proposed field demonstration study, the newly designed TESS will be deployed to multiple-zone HVAC system, upstream of the existing VAV boxes and integrated into the VAV boxes. The new controls logic will operate the VAV zone dampeners in coordination with TESS during peak demand periods to deliver performance results consistent with our current product application. What this new project offers are an advancement of in-duct thermal storage for larger buildings with VAV systems to manage HVAC loads and new controls logic to work seamlessly with the building's HVAC control system. TESS controls will interface with VAV direct digital controls (DDC) directly. It can deploy PWM compressor controlling algorithms alongside with supply fan speed controls that optimize VAV unit dampener positioning to deliver TESS cooling in lieu of conditioned air during peak periods.

The study will evaluate the performance of the TESS, the controller, effective dampener positioning logic and the overall interactive effects to attribute savings to the different elements of the system in kW, kWh, and GHG. Results will be presented for summer peak period and remaining off-peak periods – focusing on overall daily operation to show peak demand reduction, peak period load shift and energy efficiency.

Project Details	
Submitter	AESC
Average score	61.00
Score deviation	5.45
Project ID	1238960304
Technology area	Plug load and appliances
Project type	Technology development research
Research type	Field demonstration
Target market	Commercial
Timeframe	18 months
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 6.7 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• It aligns with TPM priority, however, what's new learning, if this system presents a tweak with the previous system?

Feedback

• The main barriers identified for this HVAC Research Area (Scalable Thermal Storage) is the complexity, cross trade coordination and risk of reliability. The proposed project is highly complex and has the potential for impacting the occupant comfort. It will rely on a combination of mechanical HVAC and controls contractors and include a very sophisticated and complex SOO to control the VAV and also the main AHU. I am rating this at 50% because this project does not appear to provide potential solutions to the identified barriers.

Technology Transfer and Program Alignment

Average Score: 7.5 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• The proposal should discuss technology transfer. It appears that that a prototype has been built but the system is not commercially available, which may disqualify it for CalNEXT program?

Feedback

• Energy savings are not likely, the potential benefit is for load shifting. This will be a highly custom measure, but the investigation into the use of PCM in a subset of existing HVAC infrastructure will be valuable for technology transfer and to inform future program design.

• Very low technical and market maturity for the VAV box and variable volume reheat application of the technology. Load shift measures are not currently part of the portfolio.

Utility and Energy Efficiency Program Benefits

Average Score: 7.5 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• It may be beneficial to meter and weather normalize the supply fan energy and compressor/ chiller energy separately.

• It appears that benefits may derived from single zone Unit. It's not clear how the results in a multizone variable volume were derived with reheat application?

Feedback

• Load shifting benefits are TBD. No significant energy savings identified to be a result. The energy savings that are mentioned are more a result of the upgraded DDC for buildings with antiquated systems, not the thermal energy storage measure.

• Benefits are described clearly, although all the data comes from single zone unit installation and single zone constant volume units. This application is different enough to make the estimates very

rough and perhaps incorrect. There is no discussion of the factors that will change the results in a multizone variable volume with reheat application.

Underserved Benefits

Score: 6 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

PROJECT IMPROVEMENT SUGGESTIONS

• Proposal states that retrofitting HTR commercial buildings with Rooftop HVAC Units located in DACs is a focus. And that the site it selects may be in a DAC.

Project Clarity

Average Score: 4.2 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• It is recommended to include a monitoring point of HVAC zone set point temperature vs actual pre and post installation of the TESS.

• Energy savings and GHG emissions reduction should be clearly quantified, and how these could be used for market transformation.

Feedback

• The project scope is clearly defined. The expected outcomes are "somewhat reasonable". The potential for the load shifting seems dependent on examples of constant volume systems. A VAV system uses the fan energy and volume of air to transfer the energy. I can envision situations where the fan energy may need to increase to meet space set points during peak periods, if space setpoints are held constant. There will be interactive effects between the zone control of the VAV box and the main RTU/AHU fan that were not acknowledged in the submission.

• The proposal assumes that a PCM product that worked on single zone constant volume units will work on variable volume multi zone units. There is zero discussion of the multiple reasons why VAV systems will produce different results and challenges. A partial list includes: (1) VAV multi zone systems also have reheat and code requires SAT reset to minimize reheat energy and increase economizer hours, often through a 10*F range. How is the PCM melt temperature tuned to SAT reset range and will the PCM be discharged at the wrong time? If not, how will SAT reset controls be managed in coordination with PCM optimization controls - likely a very complex problem. (2) Many buildings don't have enough space between the duct mains and VAV boxes to insert this

device. (3) VAV box control is complex as it needs to manage minimum ventilation rates delivery to the zone, heating control of a hot water valve and airflow dampers, cooling control of a hot water valve and airflow damper, and send demand signals to the AHU controller for demand based resets of SAT and static pressure. Zone controls are also overridden by outside signals such as occupancy (to set zones in occupied standby mode - as required in code), CO2 sensors for DCV control, etc. The proposal describes interfacing with the existing BAS and controlling the damper optimally to utilize the PCM but says little about how this will occur. Is it though an outside device that overrides control over BacNET? There is mention of a thermostat the vendor has programmed previously - is the idea that somehow this thermostat will take over all the other existing VAV zone control? That solution is unlikely to be feasible. There is no discussion of the control logic needed to interface with existing VAV functions and utilize the PCM, which would likely require overriding or changing the control logic at every zone and at the AHUs (increase recirculated airflow with compressor off during DR event) - giving the impression that that control logic has not been bench tested. Given the system complexities, a lot of control logic development, modeling, and testing should be done before field testing. This is at a low TRL level and poses many challenges not addressed in the writeup.

Project Innovation / Justification

Average Score: 4.2 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- Clarity on novelty of this system

Feedback

- The technology is the same, the system that is proposed to be applied to is different. No quantitative estimates provided.

- limited of incumbent technology or alternatives, such as thermal storage at the HVAC unit (rather than at every zone VAV box), in the duct main (rather than at every VAV box), or using the building mass as thermal storage with pre-cooling. Also, see comments in Project clarity above.

Project Readiness

Average Score: 8.3 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

- Target sites should be based on HVAC system and size (capacity and supply air delivery volume, number of VAV zones) and not focused on the building area.
- Both timeline and budget seem a bit excessive

Feedback

- Potential test sites have been identified, control logic has been developed.

Stakeholder Engagement

Average Score: 7.5 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Reasonably good

Timeline

Average Score: 4.6 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- 12 months may be preferred

Feedback

- 18 months has been identified as the project timeline.

Cost

Average Score: 4.6 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- $250K

Appendix Q Laboratory Evaluation of Residential Smart Panels

With increased residential electrification, households are reducing their carbon footprint by replacing gas appliances and vehicles with all-electric alternatives. In California, the state has set a goal to reach reach 100 percent zero-carbon energy by 2045 (Executive Order B-55-18). While the reduction of GHG emissions is positive, electrification increases the strain on electrical infrastructure. Many existing homes are not equipped to handle the additional electric load that electrification creates due to electrical service and panel limitations.

The National Electric Code (NEC) section 220.80 provides methods for determining a home's minimum panel size during construction, but common sizing becomes inadequate when considering California's electrification goals. It doesn't consider future needs such as a home's transition to electric appliances nor the addition of electric vehicles. Based on a study by Pecan Street, a home that is not equipped with an electric oven, cooktop, and water heater would be unable to electrify all three devices without an electrical panel upgrade. These three devices will typically double a home's amperage requirements, far exceeding the minimal electrical panel size recommended by the NEC. Amperage capacity issues increase dramatically when adding electric vehicle charging to the equation. From the Energy Star EVSE database, 91.5 percent of Level 2 EVSE draw 7 kW or more. This translates to additional current requirements of 29 amperes (amps), which results in the need for a panel upgrade in most existing residential scenarios. It's estimated that 46-58 percent of the the country's 86 million single family homes will require a panel upgrade to support full electrification. This means 5.5 million Californian households will require expensive and time-consuming electrical panel upgrades to fully unlock electricification's as-advertised benefits.

One emerging technology category aims to be the enabling solution for residential electrification, Smart Panel technology. Some Smart Panels include features to manage total current draw and can replace a home's existing electrical panel, bypassing the need for a panel or service upgrade. These Smart Panels can also deliver improved efficiency via whole home energy savings features. A smart panel monitors a home's electricity consumption and turns off lower priority circuits to ensure active loads remain under the home's maximum rated electrical service and panel requirements. This in turn can also allow for an increased number of connected electrical devices. Some smart panels can even integrate with existing DERs to enable load shifting and electricity export back to the grid.

While other technologies exist for solving these issues, smart panels offer the most comprehensive advantages. Smart panels allow for full control over the homes connected loads. Other devices such as circuit control units (CCU) and outlet splitters only offer limited control of connected loads and are often limited to basic control strategies that control loads based on a single condition.

Smart panels are relatively new to the market, and they are not well understood in terms of capabilities and potential. Additionally, features between any two "smart panels" can vary dramatically, because there is not a standardized "smart panel" definition. Currently, codes and standards focus only on system safety and not functionality.

UC Davis, in partnership with VEIC, will characterize commercially available smart panels and provide transparent information on system capabilities and integration opportunities. The team will assess smart panels' ability to provide energy-efficiency improvements, deliver load flexibility and reduce electrification costs for California homeowners. Questions to be answered include:

Can smart panel technology be used to improve energy efficiency in residential single family

homes?

Can smart panel technology be used to enable electrification while safely and reliably preventing overload conditions?

If proven effective in the laboratory, what market barriers does the technology face and how can future incentives or codes increase adoption?

Which utility customers would benefit from smart panel technology and what would be the overall statewide impact on energy usage and electrification should further adoption occur.

Project Details	
Submitter	UC Davis
Average score	78.75
Score deviation	10.23
Project ID	1239012719
Technology area	Whole building
Project type	Technology development research
Research type	Lab demonstration
Target market	Residential
Timeframe	18 months
Funding request	Up to $300,000

Evaluation Category	Results
Technology priority maps	No recommendations
Technology transfer and program alignment	No recommendations
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 10 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

Feedback

- Electrical infrastructure is a high priority TPM with CalNEXT role as Lead. Application addresses the barrier of "disconnect between implementers and the National Electric Code and policymakers..." and the opportunity of panel upgrades with smart panels.
- This project fits into TPMs which align with High and Lead rankings
- Aligns with the high priority, CalNEXT lead Whole Buildings Electrical Infrastructure tech family

Technology Transfer and Program Alignment

Average Score: 13.75 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

Feedback

- This proposal is focused on the functional capabilities of SP, and not as much on the suitability of SP for use in utility programs.
- Aligns with residential EE and electrification programs (supports decarb and several deemed measures). Tech transfer pathways to regulators, codes and standards, tradespeople, and programs all follow this study.

Utility and Energy Efficiency Program Benefits

Average Score: 13.75 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- The utility programs need to be told whether a SP is going to be a cost-effective measure and understanding the capabilities of the products needs additional interpretation to make these determinations.

Feedback

• This project has potential benefits to programs, but the direct use of the lab results will not be possible for utility programs without additional interpretation.

• Evaluating the load limiting abilities of smart panels is key to unlocking utility and energy efficiency program benefits of the technology.

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

PROJECT IMPROVEMENT SUGGESTIONS

• There is a heightened interest in Smart Panel technology / solutions among LI direct installation program participants, contractors, and LI stakeholders in general. In the long term, this results of the program could impact and significantly benefit DAC/HTR residential decarbonization efforts.

Project Clarity

Average Score: 8.3 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• It's not clear what the benefit of lad testing is in this circumstance. The market will decide a lot of specification details based on things like cost and ease of installation, etc. and that isn't necessarily what the role of CalNEXT projects should be. The focus should be on capabilities in SP that are needed or will be supported with program funding.

• I recommend considering the various use cases (collection of end-uses, dedicated circuits, building sizes, control schemes) and clearly defining the test plan to maximize the value of a laboratory testing opportunity.

Feedback

• This project appears to have a clear scope of work with reasonable limits. However, is lab testing truly needed for this work?

• Project scope is clear and achievable. Use cases will need to be thought out.

Project Innovation / Justification

Average Score: 8.3 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• Market studies of smart panels have been done or are underway (Energy Solutions for PCE and AESC for SCE DRET program, in progress). I suggest consulting with those efforts/stakeholders to see what added value market characterization might exist.

Feedback

• Authors note that smart panels are relatively new to the market, and they are not well understood in terms of capabilities and potential. Products vary widely in functionality given the newness of the market and lack of standards.

• As a market survey, this isn't going to be greatly differentiating from other research on SPs.

• Smart panels have clear differentiation over typical panels with potential benefits as explained in the proposal. Independent lab testing of smart panels does need attention.

Project Readiness

Average Score: 8.3 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Consider whether lab testing to the degree planned is truly needed to make actionable recommendations needed by utility programs.

• Please identify the smart panel models that will be evaluated during the project planning, if possible.

Feedback

• Project identifies a partner to conduct the market survey/stakeholder engagement, and partners with experience conducting lab evaluation for CalNEXT on other projects.

• This project appears to be ready for start-up, however the duration could be shortened considerably if lab testing isn't needed.

• Relevant codes, use cases, and market conditions are well understood. The available CLTC laboratory is a good opportunity for controlled testing at a partner's laboratory.

Stakeholder Engagement

Average Score: 8.3 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Stakeholders listed include electricians, home inspectors, building managers, manufacturers, and utility personnel... however, it is unclear how each of these groups will be relevant to the project outcomes. Some are clearer than others. The ones that aren't clear should be detailed a bit more.

Feedback

• It is unclear how each of the stakeholders will be leveraged to make the project more valuable for the utility programs.

• Appropriate stakeholder groups and the questions to ask them are identified, but not specific parties.

Timeline

Average Score: 4.2 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

• Consider whether full lab testing is truly needed to make actionable recommendations needed by utility programs.

Feedback

• The timeline can be compressed considerably if less lab testing is required.

• 18 months seems like a reasonable, average timeline for testing of three different panels in a lab.

Cost

Average Score: 3.75 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

• Please estimate share of budget for Market Assessment, Lab Evaluation, and Modeling to identify demand savings / shifting potential

• Consider whether lab testing at the level planned is truly needed to make actionable recommendations needed by utility programs.

Feedback

• Proposed budget seems to be the upper end. Please estimate share of budget for Market Assessment, Lab Evaluation, and Modeling to identify demand savings / shifting potential

• The cost can be considerably compressed if lab testing at the planned level is not required.

• Cost seems slightly higher than what I would expect for controlled laboratory testing of three panels.

Appendix R Medical Devices Market Characterization Study

VEIC proposes a market study of energy efficient medical devices. The market study will quantify the potential for energy savings, identify the most efficient device types, define the mechanisms for achieving higher efficiency, and recommend efforts for achieving higher energy efficiency and savings in the CA market. The research team will engage stakeholders in medical device manufacturing and sales, the U.S. Department of Energy ENERGY STAR program, healthcare facility operation, medical insurance administration, and efficiency program administration to inform the findings and recommendations. The study will address opportunities for medical devices used in a household setting and medical devices use in a healthcare facility setting.

Project Details	
Submitter	VEIC
Average score	76.75
Score deviation	3.95
Project ID	1238907449
Technology area	Plug load and appliances
Project type	Technology support research
Research type	Market characterization/study
Target market	Residential
Timeframe	9 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	No recommendations
Timeline	No recommendations
Cost	No recommendations

Criteria

TPM Priority

Average Score: 9.375 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- While the plan identifies equity as a key consideration, in the market characterization, be sure to document how the analysis will capture equity implications of efficiency gains and potential distributional impacts of energy, health, and income benefits.

Feedback

- The project aligns well with the current calNEXT Technology Priority Maps for opportunities and addresses barriers spelled out in the TPM.
- The TPM alignment is good. The project specifically targets energy efficiency of medical devices and names CPAPs, imaging equipment, dialysis, and ventilators as examples.
- This technology area aligns with the Medical Equipment research area (medium priority) within the Plug Loads and Appliances & Appliances technology category, as well as the Labs & Hospitals research area (medium priority) within the Process Loads technology category. It addresses the barrier of lack of knowledge related to medical devices in general.

Technology Transfer and Program Alignment

Average Score: 12.1875 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Clearly define the technology transfer pathway for this project.

Feedback

- The project will fill an identified information gap to incorporating medical devices into programs. The proposal provides justification for independent work to explore this area as Estar is lagging in development of efficient solutions in this area. The technologies have potential to directly impact

low income / sensitive communities as the project will address technologies commonly used by elderly and at risk populations.

• Project is well positioned for integration into a new or existing program, or to scale the adoption of a technology. Technology Transfer pathway is broadly described but likely aligns with Measure Study/Recommendation category.

Utility and Energy Efficiency Program Benefits

Average Score: 11.25 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• The plan would benefit from more clearly laying out the magnitude of energy savings possible through addressing the identified devises. It would also benefit from making a clearer delineation between filling the identified information gap and adoption of the identified technologies.

Feedback

• The project will attempt to fill an information gap necessary for expanding efficient measures available in healthcare settings. The proposal does not identify the expected magnitude of this challenge, nor does it directly tie the identified information gap to realized energy savings.

• Project has strong benefits to the utilities and energy efficiency programs.

Underserved Benefits

Score: 3 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

• Consider using CalEnviroscreen 3.0 https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30 as needed for targeting areas or when evaluating results of the market study.

Project Clarity

Average Score: 8.125 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Please clarify how the database will be delivered. Who will host/maintain the database, who will have access and how?

Feedback

• The scope and expected outcomes for this project was clearly presented through listed tasks.

• The scope lists constructing a database to help fill an identified information gap but does not list the database as one of the deliverables. It also does not address who will host/maintain the database and how.

• Scope and expected outcomes are obvious, reasonable, and achievable.

Project Innovation / Justification

Average Score: 8.125 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• The plan would benefit from providing a greater sense of market size, energy consumption, savings potential, and distributional impacts. (e.g. There are an estimated X units annually consuming Y MWh, with Z% in low income or elderly populations).

Feedback

• The project will provide energy savings estimates as part of the scope, but does not provide a sense of the anticipated magnitude of the problem currently.

• This project will provide missing market data on medical devices. The energy impacts are part of the scope.

Project Readiness

Average Score: 8.125 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• The plan would benefit from more clearly outlining the delivery strategy, particularly for the database and saving estimates. Who will host the database? How will this be determined? How will the database be maintained? How often? How will savings estimates be determined? How will savings estimates be presented?

Feedback

• Project looks to be well organized for success.

• Several deliverables would benefit from greater clarity. For example, more information regarding the database and savings estimates are needed as these are core deliverables.

• The Project has great information about how it will be delivered and has identified partners. Information indicates that the project has strong chance of success within the estimated budget and timeframe.

Stakeholder Engagement

Average Score: 8.75 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

Feedback

• Has project team considered incentives to participate in surveys for some of the stakeholders listed?

• The plan clearly outlines the stakeholders and provides opportunities to gain input from them throughout.

• Project has a comprehensive list of stakeholders, how the stakeholders are impacted by this work, and a plan for how they will be engaged during the project.

Timeline

Average Score: 4.375 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

Feedback

- 9 months seems reasonable for this project.
- The timeline follows industry standard guidelines.
- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes with 9 months listed.

Cost

Average Score: 3.4375 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

Feedback

- Are there any incentives for stakeholder participation included in this budget?
- Budget estimate of $200k are seem very high given the scope largely being interviews and literature research.

Appendix S Multi-purpose Hydronic CO2 Heat Pump for Commercial Buildings

The two largest decarbonization targets in a commercial building are typically space heating and domestic hot water. Just these two end-uses account for well over 90% of the natural gas usage in most commercial buildings, excluding food service. Energy efficient, cost-effective solutions for decarbonization of these commercial building loads demand emerging technology solutions. There are economic, feasibility, and technological challenges that need to be explored and addressed through the study of early adopters and newly available products.

A newly developed, high-efficiency CO2 heat pump technology can provide space heating, space cooling, and domestic hot water. This new product can produce higher temperature water than previous CO2 heat pumps which can suffice for space heating purposes. This capability enables the low-GWP heat pump to be used for multiple purposes while also replacing the chiller used for space cooling. This aspect can avoid costly electrical and utility infrastructure upgrades by relying on the same service capacity that the space cooling chiller would have while simultaneously providing heating and hot water, all with high coefficients of performance. The product is modular, can operate with high return temperatures, and high ambient temperatures – all of which are beneficial in the broadening of CO2 heat pump applications and usability.

This project will explore the design, feasibility, benefits, sizing, and cost of this unit as applied to an existing building. The market potential across California will be quantified, including benefits over existing baseline incumbent alternatives. The report will outline the design considerations, how the system would integrate into the building, and provide recommendations and a roadmap for manufacturers, engineers, and utility programs. The design will be based on an actual building to inform a subsequent field demonstration in a planned follow-up study.

Project Details	
Submitter	AESC
Average score	63.44
Score deviation	15.52
Project ID	1239015384
Technology area	Heating ventilation air conditioning (HVAC)
Project type	Technology support research
Research type	Measure development enhancement
Target market	Commercial
Timeframe	12 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 8.125 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• Project concept falls into TPM priority but it doesn't qualify for CalNEXT funding because this technology is NOT commercially available.

• I suggest adding alignment with the medium priority research areas of Refrigerant Management & Low GWP Transition, as the outcome includes "a roadmap for manufacturers, engineers, and utility programs" to expand options for low-GWP heat pump technologies.

Feedback

• Project is clearly aligned with TPM priorities. How or to what extent the project will provide key insights on the opportunities and barriers is not fully described.

• The project is early stage feasibility i.e., paragraph 3, section 11: "This project will explore the design, feasibility, benefits, sizing, and cost of this unit as applied to an existing building."

• As described in the Project Intake Form, this project directly addresses the opportunities and barriers of the identified high priority technology research areas.

Technology Transfer and Program Alignment

Average Score: 10.3125 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- It would help to describe the specific types of information (e.g. calculations) that will be produced by the project which will feed into development of a new measure.
- The proposal needs to establish stronger linkage for designing incentives for customer adoption.
- It is somewhat unclear as written. I suggest clarifying how this project will address tech transfer, such as specifying whether this research will support new measure package development or existing measure revision, or whether the technology will require a custom measure approach or tool, or if multiple pathways may be suitable.

Feedback

- Project aligns with utility programs in terms of the technology type and its application. However, it is unclear how study of the design of a system without the installation and operation of a system will provide sufficient information for utility programs.
- Primary chiller replacement can be expensive and pose a significant disruption to building operations. Market demand may be limited outside of buildings planning to replace older chillers for or planning ahead for replace on burnout.
- The project is well positioned for integration into programs, and the technology transfer pathway is broadly described as requiring development of "energy efficiency measures with incentives" and "tech transfer to a broad set of implementers to encourage natural market adoption" by supporting "new/updated custom measure."

Utility and Energy Efficiency Program Benefits

Average Score: 10.3125 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Proposal should elaborate on the benefits to Utilities such as EE, load flexibility, and energy efficiency.

• Please explain how the project will determine benefits. I suggest adding specific performance metrics to the Project Plan that showcase the efficiency gains of the CO2 HP system compared with the alternatives. For example the Intake Form notes that CO2 HP have "high coefficients of performance," and it would be good to elaborate and specify with actual COP values compared to baseline or alternate technologies.

Feedback

• The technology has benefits for decarbonization, but it is unclear how energy efficiency will be realized through the technology and actionable through the study.

• Efficiency, avoiding service upgrades, potential for reduced peak demand

• Proposal should provide details on EE, load flexibility and other measures.

• The project aims to explore potential CA market benefits, and the technology description suggests that there are multiple benefits related to energy efficiency and electrical utility infrastructure management. Although, the magnitude of the benefits is yet to be determined, and the outcome of this project will not directly lead to immediate program opportunities, since it "paves the way" for a new measure, but will not actually develop a new measure nor conduct a field demonstration.

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

• Project will identify / coordinate with one or more potential sites to act as prospective early adopters of the technology. Consider using CalEnviroscreen 3.0 https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30 as needed for identifying project site.

Project Clarity

Average Score: 5.625 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Recommend a focus beyond feasibility to a focus on costs and cost-effectiveness for designed solutions.

• DAC question 18 says that this is a field demonstration. But the project scope is for the planning and market assessment that comes before a field demonstration.

• Any tangible outcomes?

• I recommend rethinking the scope to either be a field demonstration or a market assessment. The field demonstration path will provide more definitive and specific findings related to overcoming barriers for this technology in commercial sites. If the field demonstration path is taken, please provide more detail how the site will be selected or if the site(s) have already been identified, and what type of site agreements will be in place. Also, in the Project Planning phase, please describe what the risk management plan is in case that host site cannot be secured. Alternately, if the market assessment path is taken, ensure that the scope of the research is additive to the what the currently active "Market Characterization of Ultra-Low GWP Space Conditioning Heat Pumps for Commercial Buildings" project is investigating, such as by focusing on the combination space/water heating application. Additionally, if the market assessment path is taken, I suggest including some modeling and analysis component to determine potential savings estimates, as that is not currently included in the scope.

Feedback

• The outcome is a report on feasibility and design study. Is feasibility in question? Could a design-only project establish a conclusion on feasibility?

• The scope includes language related to a market assessment, and also includes a feasibility/design study, but stops short of including a technology demonstration. There is no description of how benefits and savings estimates will be determined, such as through energy modeling or otherwise. I have some concern that there is a risk of identifying a potential host site (scope item #2), and that the market assessment may be duplicative of some research another active CalNEXT project is actively conducting, see notes in the "Innovation/Justification" comment below.

Project Innovation / Justification

Average Score: 6.875 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• Are customers concerned that a failure in this equipment could take down their cooling and hot water and part or all of their heating? Would there be a need for greater redundancy in the design for this kind of multi-function equipment compared to single function equipment?

• Several Combo systems are available commercially but they use other low GWP refrigerants and not CO2. This is a concept that is risky and may not be realized.

• I suggest providing additional details on how the project will estimate potential energy, carbon, and demand reduction, or if and how it can produce key inputs that can be used to determine those impacts in the future. I also suggest coordinating with the Commercial and MF CO2-based

HP and Market Characterization of Ultra-Low GWP HP projects to share findings, as there may be some cross-over in target markets between that project and this one.

Feedback

• The energy efficiency of the proposed system type should be explicitly included and described in the scope and outcomes of the project.

• Ultra Low GWP + serve multiple functions and higher efficiency.

• The intake form has very limited information on energy, carbon, and demand impacts. There also are are some active CalNEXT projects conducting related research: "Commercial and MF CO2-based Heat Pump Water Heater Market Study and Field Demonstration," and "Market Characterization of Ultra-Low GWP Space Conditioning Heat Pumps for Commercial Buildings" While these projects do not seem to be conducting exactly duplicate research, there may be some cross-over. This project does stand out, however, in that it seeks to address the use of CO2 HP for combination space and water heating, while the above mentioned projects are focused on either space or water heating.

Project Readiness

Average Score: 6.875 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• It is a concept and hence it is not ready to be implemented.

• For the Project Planning phase in the future, I suggest describing in more detail how the project will deliver on the scope. For example, what are some specific sources for literature research and market data will the project team utilize? Also describe more detail about what is included as the project team explores the path to technology transfer, item #4 in the project scope. Can the project team also expand on scope item #5, specifically which parameters for new measure development will be an outcome of this project? And how will the project determine the magnitude of potential savings and benefits?

Feedback

• Will look for sites as part of project

• The intake form has limited information about how it will deliver the project. It does have identified partners for many of the activities (although the names are redacted so I am unable to consider how suitable and appropriate those partners are).

Stakeholder Engagement

Average Score: 6.875 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Address market barriers in the plan for stakeholder engagement.
- To some extent
- I suggest including a plan for engaging with utility EE program staff to gather feedback on their interest and concerns related to this potential new measure opportunity, and how all the stakeholders will be engaged in the project, such as which milestones or key findings that will prompt stakeholder engagement.

Feedback

- It is unclear if design engineers and market participants will be included in stakeholder engagement. There are stakeholders recognized as lacking awareness and guidance.
- Adding some engagement with custom programs would strengthen the project.
- The project describes who stakeholders might be and how they will identify and engage stakeholders as part of the project, but does not mention engaging with utility or EE program staff.

Timeline

Average Score: 4.375 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Looks reasonable
- I suggested providing more description on the timeline associated with specific tasks so that it is easier to gauge if there is any concern that the timeline is at risk.

Feedback

• Project timeframe is listed at 12 months, and is within industry standard timeline given the scope and expected outcomes.

Cost

Average Score: 4.0625 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

• Reasonable

• I suggest providing more detail on how the cost breaks down by project activity and by project partner, as this will enable a more informed determination of reasonableness of the costs.

Feedback

• Budget may be a little high depending on the depth of market research and technology transfer preparation

• The budget estimate is provided as a single number, and seems reasonable only if the project team chooses to modify the scope to include a field demonstration. In that case, I recommend working to get the low CO2 HP equipment donated for study purposes so that it does not impact the project budget. If the project team chooses to stay with a market assessment, then the cost is likely too high.

Appendix T New CFS Measure Prioritization

This project aims to develop a database of potential new electric commercial foodservice (FS) measures. This database determines which technologies can be successful and cost-effective in energy efficiency programs by using preliminary data to prioritize and identify kWh savings potential, cost data, and promising market analytics. There have been several recently developed measures which did not reach our target performance metrics, in part due to a lack of pre-development screening and datapoint consideration. We intend to conduct an extensive data collection effort including discussion with market actors, preliminary calculator buildouts, measure cost and incremental measure cost (IMC) analysis and testing where necessary. Our goal is to amass a comprehensive set of data in a user-friendly database, enabling off-the-bat organization and ease of access while developing the baseline for educated, effective measure selections and future measure prioritization.

Project Details	
Submitter	Energy Solutions
Average score	67.50
Score deviation	8.42
Project ID	1238862281
Technology area	Process loads (commercial, industrial, agriculture, water)
Project type	Technology support research
Research type	Tool development/enhancement
Target market	Commercial
Timeframe	6 months
Funding request	Up to $100,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project not a good fit to provide DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	No recommendations

Evaluation Category	Results
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 6.875 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• The proposed project would be strengthened if amended to include electric service modification costs as part of the IMC. Prioritizing FS efficiency opportunities based on equipment cost only may mischaracterize the customer investments need to transform this market and realize any forecasted savings.

Feedback

• The proposed project aligns with the Food Processing, and Restaurant and Food Equipment technology research areas of the process loads TPM. This project does not clearly address the barriers of either relevant technology research area.

• TPM alignment is good

• It is aligned with process TPM, Restaurant and Food Equipment, which has collaborate & medium priorities.

Technology Transfer and Program Alignment

Average Score: 12.1875 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Proposal would be strengthened by the including measure package development activities for the best opportunities. This would increase the likelihood of technology transfer.

• Expand project summary to provide a list of example equipment types where we don't or have not had an incentive program to demonstrate the value of this list of cost effective options for future programs development. What is the update of incentive programs in foodservice as a

proportion of the applicable foodservice establishments that qualify? Elaborate to explain the value of this project

Feedback

• The deliverable produced could by used by efficiency program providers to prioritize and bolster their food service efficiency portfolio.

• Many low hanging fruit electrical technologies have already had incentives developed. Uptake of POS incentives for foodservice applications is historically low. Don't see the value of continuing to invest in this segment versus other commercial segments that don't have decades of incentive program development.

Utility and Energy Efficiency Program Benefits

Average Score: 13.125 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Add KW savings and load flexibility to spreadsheet headings. How can it benefit other utility needs such as code readiness and C&S CASE measure development?

Feedback

• This project has clearly defined benefits for utilities and energy efficiency programs.

• No discussion of KW savings opportunity, Demand Response, load flexibility component of measure list for utility benefit.

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Average Score: 6.875 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Please provide more detail for each of the major components of the scope bulleted in the proposal, as well as the expected outcome of the project. Please also describe how you plan to conduct your research to guarantee quality.
- Update Project Value and Impact section to discuss how to cross reference this spreadsheet with existing installed base of gas equipment. Is there a list? What is the market landscape at Point of Sale with the operator relating to equipment performance and especially affordability with installed cost and operating cost, especially when fuel switching.
- Project scope should clearly indicate how they plan to collaborate with other stakeholders and incorporate past program experiences. It should also include TSB analysis.

Feedback

- The scope and expected outcomes are somewhat clear and probably achievable.
- It would be useful to understand how forthcoming FS industry has been with sales data.
- Not sure how this electric only spreadsheet supports identifying fuel substitution measures. The market landscape section is also one that needs attention, lots of focus on upstream barriers with the vertical supply chain, how about barriers at POS
- Per TPM, project should collaborate with other stakeholders. The scope should also include TSB analysis.

Project Innovation / Justification

Average Score: 6.875 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- List low hanging fruit work papers and eTRMs over the last 20 years. List large list of opportunities that have not been previously vetted or eTRM developed. How is this project innovative?

Feedback

• This project indicates moderate to strong differences with incumbent technology, but has limited information on energy, carbon, or demand reduction estimates. These savings are proposed as part of the deliverable.

• There has been work in this area for decades, not sure why CalNext should fund this versus regular incentive program funding channels? More explicit information in justification section would help.

Project Readiness

Average Score: 6.875 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Collect data on the operator for each prospective measure on if they need it based on current utility rates and financial position, etc.

• The criteria for which products to be included in the database should be defined and consulted before product research is initiated.

Feedback

• The Project has good information about how it will be delivered and has identified partners. Information indicates that the project has good chance of success within the estimated budget and timeframe.

• The steps highlighted don't account for the operator

• The project scope appears to be broad.

Stakeholder Engagement

Average Score: 6.25 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Efficiency program providers and IOU's could provide valuable feedback during the measure prioritization phase. This proposal would be strengthened by including them as stakeholders prior to the completion of the final deliverable

• Restaurants are going through a tough time, are they in the position to buy new equipment, does new electrical appliances pencil out for them? Seems that they are a key stakeholder not mentioned

• Given that there are existing FS programs, the project should make sure that the stakeholder engagement is made before the data is collected to understand the existing program offerings and barriers.

Feedback

• Project proposal describes who the stakeholders will be and how they will be engaged.

• Expand list of stakeholders for POS FS Program spreadsheet

• The extent and timing of stakeholder engagement is not clear from the project scope.

Timeline

Average Score: 4.375 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

Feedback

• The project timeframe estimates are within industry standard timeline given the scope and expected outcomes.

• Timeline is appropriate

• Project timeframe estimates are within industry standard timeline given the scope and expected outcomes.

Cost

Average Score: 4.0625 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

• Consider refining the market segment or technology group to be evaluated to ensure that the deliverable can be provided on budget.

Feedback

- Budget seems low given the breadth of equipment to be surveyed and evaluated.
- Cost is appropriate
- Budget estimates are realistic and aligned with the program expectation.

Appendix U NZE Buildings as Grid Stabilizers

This project assesses how templated building designs can help stabilize the grid.
Goals are to establish in California:

1. Green Template Time-of-Day-Value Net Zero Energy designs for ADUs & small homes, stacked flats, townhomes, and hotels adapted to CA building practice as teaching & adoption tools using locally available materials.

2. one or more social impact Makers Workshops to supply R7 & R9 windows,

3. architects, builders & engineers educated in their integration in 24" on-center framed envelopes to DOUBLE whole wall thermal resistance at LESS first cost, that in turn develop…

4. …a pipeline of new construction building demos across CA.

WonderWindows are multi-pane fixed acrylic windows that fit 24" on-center wood frame residential & light commercial new construction buildings: the type of buildings that make up most of the built environment & create most of CA's peak demand & consumption.
A peer-reviewed paper given at the ASHRAE BUILDINGS Conference in December showed that the windows eliminate 7.2sf of thermal bridging framing & 2.4sf of PVC window frame per window to DOUBLE whole wall & window thermal resistance at LESS FIRST COST.
Framing factors, the amount of wall occupied by low thermal resistance framing, can go from 21% of wall area with 16" on-center studs to 9% of wall area.
The windows have been tested to thermal/optical NFRC & air/water/structure North American Fenestration Standards. The ICC-ES reviewed the Company's Quality Production Manual & pilot workshop site for Quality Assurance & Control.
300 sample & full-size windows have been made in a social impact Makers Workshop hosted by the Boys & Girls Club of the Gulf Coast in Bay St. Louis, Mississippi. Disadvantaged, at risk makers have been paid $20/hour Living Wages to assemble the windows from pre-cut parts ordered from a national supplier with 4 California locations.
R&D with ORNL & MS State University is modeling NZE 'Green Template' designs for a range of common building types harnessing the affordability of this integrated envelope solution for ADUs & small homes, townhouses, stacked flats, and hotels.
CalTestBed has funded LBL's FLEXLAB demo optimizing solar control & the number of glazing layers according to climate zone & compass orientation.
A 672sf Net Zero Energy home is set to start construction in Chico as the first building demonstrating this technology & practice integration.
Title 24 calcs for the Chico 672sf home show a 16% savings in Gross Energy Use Intensity over the already stringent code Standard. A modest 3.5kw solar array produces NZE performance compared to the Standard using a low 15.5 KBtu/sf/year.
Multiply 15.5 KBtu/sf/year savings x 123,000 new residential units/ year x 1500sf estimated average divide by a high SEER 20 Btu/w= 143GW saved annually, perhaps double that including light commercial.
Savings could be higher, as buildings minimizing thermal bridging maintain comfortable Mean Radiant Temperatures at lower temperature setpoints in winter (and higher in summer) than conventional buildings.
Demand Side Management switching of heat pumps every 15 minutes could cut demand related to space conditioning in half but maintain comfort.

Project Details	
Submitter	GS Research LLC
Project ID	1193466496
Technology area	Whole building
Project type	Technology support research
Research type	Field demonstration
Target market	Residential
Timeframe	18 months
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	No recommendations
Cost	Project improvement suggestions

Criteria

TPM Priority

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- Answer how these additional barriers will be addressed: possible code compliance barriers for Egress and OVE framing scheme

• The project is focused on tech transfer but it misses to show the technology readiness. I think the solution is not market ready yet to focus on tech transfer. It is a whole building integrated solution so it needs more validation before it could be absorbed into CalNEXT. The product needs more advancement support.

Feedback

• Essentially this is a windows project that most closely aligns with Whole Building - Envelope. Envelope is a medium priority Technology Research Area. The project aligned with the TPM, but does not clearly address key needs.

• Project aligns with the Whole Buildings Design & Construction topic (high priority).

• Alignment with TPM, however a few minor barriers that might be show-stoppers. These include potential construction industry related lack of understanding as well as possible code compliance barriers for Egress and OVE framing scheme

• Covers one of the priority TPM areas i.e. whole buildings

• Project is aligned with the Design & Construction 2022 Technology Research Area under the Whole Buildings TPM which is considered 'High Priority'. Project directly addresses key needs identified in the “Opportunities” or “Barriers” section of a high priority technology family.

Technology Transfer and Program Alignment

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Describe how a new windows measure could integrate into an existing program.

• Address potential Barriers - is OVE allowed in CA residential building code. Also how code egress and ventilation requirements can be met if all the windows are fixed and inoperable.

• It sounds like an effective solution but the actual market ready product description is missing.

Feedback

• Project is well positioned for integration into a new or existing program. Technology Transfer pathway is not clearly described but may align with New Measure Package Development

• Product is positioned for integration into EE portfolios and is looking for funding to encourage adoption of the technology.

• Great potential to move the construction industry towards a framing technique that has been in the codes for over 30 years if allowable in CA Residential building code.

• I do not see information on completed past the field demos. In addition looks like only single manufacturing solution.

• Project is well positioned for integration into a new or existing program, or to scale the adoption of a technology. Technology Transfer pathway is broadly described but likely aligns with Technology/Program Support

Utility and Energy Efficiency Program Benefits

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Address more thoroughly the grid impacts

Feedback

• Project has strong benefits to the utilities and energy efficiency programs with lower embedded carbon and the ability to save energy and peak load.

• Project has clear benefit to the utility, based on calculations presented regarding increased energy efficiency. Improved building envelope also leads to greater ease of load shifting for DR using HVAC technology.

• Well quantified benefits, expand on grid impact

• This solution is great future solution and needs more of DOE research funds for advancement/development. From the description the solution does not sound fully ready for program implementation.

• Energy efficiency benefits of Green Template designs are clearly described.

Underserved Benefits

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Narrow the scope. Talk about getting your windows in buildings and testing the results including measured energy performance and customer satisfaction surveys. A large concern with acrylic windows is how the optics will hold up over time. Should address that concern in some way.
- Improve window assemble and integration with WRB and Air Barriers before templated for production
- The project needs more scope description which is currently missing. Is it a field demo? how many installs? etc.
- Project focus is on technology dissemination, so key performance indicators/metrics should be identified.

Feedback

- The project as described is largely a marketing effort to do outreach and education around a novel window design can integrate with Net Zero Energy Buildings and do ASTM E72 testing on the proposed windows. And while you expect demonstration buildings will be completed, you have only committed to building 300 full-size windows as part of the project which will be offered at a reduced cost to the end user.
- Funding will be used to educate architects, designers, and builders, as well as conduct Maker Workshops that benefit disadvantaged communities.
- finalize window design and concept - 4 panel, 6 panel, etc.
- Clear project scope is missing.
- Scope and expected outcomes are generally clear, reasonable, and achievable.

Project Innovation / Justification

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- One of my concerns is the lifespan of the technology, which is not discussed in the proposal. Acrylic windows may scratch and yellow over time, leading to quicker replacement. This could reduce cost savings and total emissions savings related to the technology. May be helpful to provide a life-cycle analysis.
- Build and test some models, real-time assess affordability and buildability
- It's unclear how 'Green Templates' differ from modern building design other than 24" framing and windows.

Feedback

• Project indicates strong differences from incumbent technology. It has limited information on energy, carbon, or demand reduction estimates. Project does not include calculations and research on energy and demand reduction savings.

• This technology (acrylic window) is expected to provide greater whole-building energy efficiency at a lower cost.

• OVE framing has been around for decades and allowance included in the national model codes. It's a great time to apply it to its 2 best uses - housing affordability and envelope optimization

• Advance solution but yet to be market ready. Needs more information on field performance.

• 16% savings in gross energy use compared to code standards. Project indicates slight differences from incumbent technology. It has limited information on energy, carbon, or demand reduction estimates.

Project Readiness

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Again, narrow the scope and measure performance in demonstration buildings.

• Ditto above

Feedback

• The Project has good information about how it will be delivered, but it has not identified partners that will build buildings with the subject windows except for one 672 square foot Zet Zero Energy home in Chico that is already underway outside of this project. Information indicates that the project has moderate chance of success within the estimated budget and timeframe. Sucess being defined by your description in expected outcomes.

• Plan for educational outreach and maker workshops seems reasonable.

• If all the partners are still lined up, this plan could work.

• The Project has good information about how it will be delivered, but it has not identified partners. Information indicates that the project has moderate chance of success within the estimated budget and timeframe.

Stakeholder Engagement

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Describe involvement of stakeholders mentioned.
- Begin stakeholder engagement ASAP

Feedback

- Project has a comprehensive list of stakeholders, how the stakeholders are impacted by this work, and a plan for how they will be engaged during the project.
- Stakeholder involvement needs more clarification.
- All the right actors seem identified
- Project describes who stakeholders might be but does not describe how they will be engaged.

Timeline

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

Feedback

- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes.
- 18 month timeline seems reasonable to conduct the amount of events described in the proposal.
- 18 months should work
- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes.

Cost

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Eliminate scope items that do not align with CalNEXT objectives. Example: outreach and education to architects and builders that is not directly related to the project.
- Conduct cost estimates real-time

Feedback

- Budget estimate is not aligned with program expectations. Total project cost estimate is very high relative to scope/outcomes.
- Cost is aligned with what may be expected to produce and deliver educational materials to architects, designers and builders and conduct workshop (includes material cost for 300 windows).
- Take a final look and sanity check on budget - many changes in costs since mid-COVID
- Budget estimates are realistic and aligned with the program expectation.

Appendix V Overall Emissions within Manufactured Housing

The purpose of this market study is to assess the overall emissions (operational emissions and embodied carbon) in residential housing to assess the emissions reduction opportunities related to implementing low embodied carbon alternatives as well as their impacts relative to operational carbon. Currently, there are several different policy mechanisms at the state level aimed at deploying low-GWP materials widely in the building industry. One example is mass timber, a class of engineered wood products formed of composite material which is a market-ready material that could be used to replace high embodied carbon materials like steel in standard building materials and techniques. Another commercially available material with a variety of lower embodied carbon options is insulation.

This effort would examine and quantify different materials through the lens of manufactured housing by conducting an analysis of the total lifecycle emission of three different manufactured housing types. This market study will develop baseline information on total emissions associated with manufactured housing including overall market opportunity and could provide future utility programs with the data needed to develop a new energy efficiency incentive program or future program enhancements that incorporate low-embodied carbon tiers. The study will also provide information on the overall emissions associated with manufactured housing, with the intent that those emissions can be targeted through future incentive programs.

Project Details	
Submitter	Energy Solutions
Average score	58.00
Score deviation	17.17
Project ID	1221046040
Technology area	Whole building
Project type	Technology support research
Research type	Market characterization/study
Target market	Residential
Timeframe	18 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	No recommendations
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions

Evaluation Category	Results
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 7.5 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

Feedback

- Project directly addresses key needs identified in the “Opportunities” section of a Whole Building Design and Construction, which is a high priority technology family.
- Project falls under a lead technology family and mostly aligns with the opportunities section.
- Well-aligned with TPM
- Project aligns with the "Whole Building Design & Construction" priority area.

Technology Transfer and Program Alignment

Average Score: 4.7 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Provide more information about how tech transfer can be achieved in the long or short term.
- Add in potential outcomes that could lead to integration into utility EE/DSM programs, new or enhanced measure package, increased uptake of existing measures, new or enhanced codes & standards, Market Transformation portfolio, ESA, or non-IOU programs (CEC, Federal, CARB, etc.).

Feedback

• Project is well positioned for integration into utility EE/DSM programs, new or enhanced measure package, new or enhanced codes & standards, Market Transformation portfolio, or non-IOU programs.

• Because the outcome of the proposed work is not well-defined, it is not possible to evaluate the project's positioning in CA IOU EE portfolios

• Project potential to effect utility, ESA, or other energy related programs are low.

Utility and Energy Efficiency Program Benefits

Average Score: 5.625 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Consider extending the study to include indirect upstream energy savings associated with using low embedded carbon materials.

• Add details on any potential energy efficiency benefits to using the low-carbon emission materials.

Feedback

• There may be no energy savings from this program unless there is a small energy savings upstream in the manufacturing process. Savings is in carbon and therefore has moderate benefits to the utilities and EE programs.

• Utility and EE benefits are difficult to estimate without a defined scope

• Definition of portfolio benefits is too vague

• Project has not defined any benefits to the utilities and energy efficiency programs.

Underserved Benefits

Score: 3 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Average Score: 7.5 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Provide clarity on (1) which 3 housing types will be studied, (2) Is the study comparing carbon in distinct materials or a comprehensive look at total emissions, (3) how comprehensive will the study be? Is it just insulation, slab and framing, does it include finishes? fenestration? cladding? appliances? paint and stain?
- Develop a scope of work with specific tasks for data collection, analysis etc.
- Add more details to the scope. How will the project team compare and analyze the total emissions in three different manufactured housing? If unknown, what are the potential methods that will be researched?

Feedback

- Scope and expected outcomes are somewhat clear and reasonable and probably achievable. In the brief description the study is described as the study of commercially available materials, while in the scope and expected outcomes section the project is described as analyzing total emissions in three different housing types. It is not clear which is the real project. Is it simply a materials study or a comprehensive look at complete assemblies. Also there is not much detail on just how comprehensive this study will be or which manufactured housing types will be studied.
- The scope section is much to vague for evaluation.
- No scope of work is defined
- Scope and expected outcomes are somewhat clear and reasonable and probably achievable.

Project Innovation / Justification

Average Score: 6.25 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- Describe how this project adds to existing work but is distinctly different
- Has there been research into this area by others? If so, how will this be different?

Feedback

• It is believed that the project will provide moderate differences from incumbent technologies, but it is difficult to assess due to vagueness of the scope.

• Innovation and differentiation from previous work is not addressed

• Project does not indicate differences from incumbent research. It has limited information on carbon reduction estimates but includes some calculations and research on this as part of the project.

Project Readiness

Average Score: 8.75 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide more project clarity.

Feedback

• The Project has limited information about how it will be delivered, it has not identified partners. If the scope were more clear a better assessment could be made.

• The submitter is well positioned to execute a market study.

• The Project has good information about how it will be delivered and has identified partners given that it is a Market Study with research yet to be done.

Stakeholder Engagement

Average Score: 6.25 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• Consider investigating barriers to low carbon alternatives as part of the study scope and clearly outline how the market barriers will be studied.

• Define one or more benefits to the technology that have market barriers preventing adoption. Then explain how the current proposed project reduces those barriers.

- Add what some potential barriers are

Feedback

- Project demonstrates a limited understanding of the market landscape and barriers, and feasible paths to engage the market nor does it include this type of research in project scope. While market barriers are mentioned in expected outcomes, investigating market barriers is not listed in the scope. If market barriers are to be studied, how will that be conducted and how extensive will that research be?
- Submitter should add more details about background knowledge of embodied and operational carbon relative to manufactured housing.
- Barriers are not identified
- Project demonstrates a moderate understanding of the market landscape and barriers, and feasible paths to engage the market and it does include this research in project scope.

Timeline

Average Score: 3.75 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Adjust timeline or provide explanation of why 12 months is required.

Feedback

- Project timeframe estimates are within industry standard timeline given the scope and expected outcomes
- the timeline is reasonable.
- timeline is reasonable for a market study
- Project timeframe estimates are close to being within the industry standard timeline given the scope and expected outcomes. Would expect a market study to be closer to 6 months.

Cost

Average Score: 4.7 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Provide more scope clarity.
- Add more detail in the scope that provide justification for this budget which seems high for a market study.

Feedback

- Hard to assess given uncertainty in the scope.
- The budget may be reasonable but it is difficult to judge without a detailed scope.
- estimated cost is double what is expected for a CalNEXT market study
- Budget estimate is somewhat realistic but higher than expected and relative to scope/outcomes.

Appendix W Performance Evaluation of DC EVSE

As California continues to take a global leadership role in building and transportation decarbonization by aggressively pursuing energy efficiency and electrification measures to meet its climate goals including its 2022 Scoping Plan to Achieve Carbon Neutrality (updated and released in November 2022 as required by California AB 32), the addition of electrically-powered equivalents to replace historically fossil-fueled appliances will have a serious impact on California's total energy needs and it's relative load shapes/profiles. A major California decarbonization activity currently underway is electrification of the light-duty vehicle fleet. Currently, plug-in electric vehicles (PEV) adoption remains low due to its relatively recent (2010) market introduction. However, adoption rates have increased significantly in recent years with estimates for PEV sales as high as six percent of all new vehicles purchased in 2022. As of 2022, the size of the light-duty fleet in California was 28.2 million vehicles. If just five percent of the gas-powered fleet were to electrify, the total annual energy required to meet California's needs would be ~5563 GW-Hr annually.

For this project, the research team will focus on two distinct electric vehicle service equipment (EVSE) categories; EVSE with an Alternating Current (AC) output, and EVSE with a Direct Current (DC) output. The PEV battery ultimately requires a DC source for charging and when connected to an AC charger the PEV's on-board charge converter hardware is active. Using available published performance data, the research team estimates on-board charge converter hardware to be 80-92 percent efficient (www.ev-database.org). To date, power charging equipment under 30 kW is offered as AC Level 2, and it has relied on the vehicle's charge converter to complete the total charging pathway to the battery. Recently industry has begun to develop and offer DC chargers in this power range. While most DC charger offerings in the <30 kW range are very new to the market and not yet Energy Star certified, there are a few DC systems that report a total system efficiency of 94-95 percent in the Energy Star Database. Assuming DC chargers are ~95 percent efficient and AC chargers including on-board losses are ~86 percent efficient, then if all of the PEVs currently in California opt to use DC charging California could save up to 377 GW-Hr annually. This project will quantify the differences in EVSE charging efficiency between DC and AC chargers via a robust laboratory evaluation utilizing actual PEV components and commercialized EVSE. The project will also include analysis to quantify the state-wide impacts of DC charging including annual energy saved, demand reduction, and reductions of greenhouse gas emissions.

Project Details	
Submitter	UC Davis
Average score	69.38
Score deviation	5.25
Project ID	1238252022
Technology area	Plug load and appliances
Project type	Technology support research
Research type	Lab demonstration
Target market	Residential
Timeframe	18 months

Project Details	
Funding request	Up to $300,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project not a good fit to provide DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 8.75 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• This project plan does not focus on demand flexibility, which is a core component of the TPM for EVSE, in addition to energy efficiency. Some understanding of the how the research and technology would also contribute (or not) to demand flexibility would be helpful. The submissions mentions the potential of bidirectional DC charging, but doesn't elaborate how the DC technology provides any additional capability or benefit for that demand flexibility component.

Feedback

• EVSE technology family is a high priority family.

• TPM alignment is good.

- The project aligns with the TPM but does not directly address an opportunity or barrier.

Technology Transfer and Program Alignment

Average Score: 11.25 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- I recommend the submitter document and report costs associated with DC EVSE and AC EVSE. While the potential energy savings are meaningful, cost is a current barrier to adoption. If the EE savings prove out, it would be worth considering the incremental cost fo achieve those savings. Then, program managers may consider how much they're willing to incentivize the technology to buy-down that cost for the consumer.

- The Project Plan mentions that low-power DC charging is "very new to the market", but it is not clear what that means or what market barriers exist to this technology's growth or use in residential (or commercial) settings – or whether manufacturers have any real interest in growing their offerings for this type of technology.

Feedback

- Project may help scale adoption of a new technology through better understanding of its performance and benefits. Technology Transfer pathway for this very new and low penetration technology (low-power DCFC) is not clearly defined, but it may support a new measure package or customer measure development or measure study/recommendation given the nascency of the technology. Further, project description does not explore the unintended consequences of promoting low-power DCFC over AC Level 1 or Level 2 charging; For example, a 25-30kW charger would put 3-4 times the demand on the grid as a standard level 2 charger, significantly increasing residential energy demand. At the same time, such a charger would be highly underutilized, for the average driver, it would be in use less than 1 hour per day. Thus the energy efficiency benefits my create tradeoffs with increases in power demand where residential utility service was not intended for that level of load. While project identifies some relative costs of AC and DC charging equipment, the plan does not note or account for the potential differences in installation cost of DC equipment, particularly in a residential setting.

- The measured results and comparison could be used by the public if published, but it has not been identified how that will happen, who will publish the results, and how will they be used.

Utility and Energy Efficiency Program Benefits

Average Score: 11.25 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- In Question 20, the submitter estimates 6,968 GWh saved, annually, IF CA reaches the goal of 21 million EVs on the road by 2035, AND all vehicles us DC EVSE (vs AC EVSE). I recommend the submitter estimate the kW saved, as well. This information would provide a feel for impact to peak demand.
- Plan points to EV-database.org as a source for AC and DC charging efficiency, though that website appears to only show the efficiency of the vehicle as a whole (i.e., usable vehicle battery / range). Provide clearer sourcing for data on on EVSE technology or charging pathway efficiency.

Feedback

- Submittal has strong benefits to utilities and EE programs. It is unclear how DC vs. AC would impact potential for bi-directional charging.
- Project outlines clear benefits to utilities in terms of energy efficiency (kWh) savings, though the technology mentioned (25-30kW DC charging) has the potential to drastically increase kW demand, which goes against the state's goals. Project does not take into account the potential negative consequences of higher power charging in residential settings, where utilities aim to lower the overall demand impacts of EV charging. It is not clear how the proposed measure would fit into EE programs, only identifying that one CCA is potentially interested in the results for future program development. Given the early-stage technology, the focus at this point may not necessitate a clear program fit yet.
- The project would benefit both EV programs and utilities.

Underserved Benefits

Score: 0 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Average Score: 8.75 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Provide additional level of detail in project scope regarding methodologies to allow for better sense of actual scope and ensure validity of results.
- I would suggest at least estimating how many units would be tested in the lab setting, and describing why it would take 18 months to complete.

Feedback

- Scope and expected outcomes are generally clear and achievable.
- The scope was well planned out with a list of detailed tasks.
- Project scope is clearly outlined with appropriate staging and process. Some task descriptions could use additional detail. For example, project does not identify how many AC or DC EVSE or representative onboard chargers plan to be tested. Data Analysis section does not provide sufficient detail into the types of analysis planned to compare technology performance.
- The scope and outcomes are generally clear and seem achievable. However it is unclear how many units would be tested and how the budget amount and timeline is justified.

Project Innovation / Justification

Average Score: 7.5 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

- Project Plan should consider the potential demand increase impacts associated with promoting 25-30kW DC charging in place of 1-7 kW AC charging and how those may be mitigated in order to promote the DC technology if it is found to be more efficient. Project savings estimates are based on a full conversion of the market from AC to DC charging technologies, but should consider some range or sensitivity given the unlikelihood that all EV charging would shift from AC to DC.

Feedback

• Submittal indicates moderate to strong differentiation related to incumbents. Submittal provides some information and calculations related to energy reduction.

• Project is investigating an area/technology of clear value in terms of energy efficiency benefits, if proven; however, the project plan does not account for the potential unintended consequences or costs associated with the DC charging technology being investigated; While the technology may show valuable energy savings, other barriers (cost, feasibility of installation) or challenges (increased demand from higher power charging) may limit this technology's potential uptake, and these concerns are not mentioned at all in the Plan. Further, project savings assumptions are based on estimates of AC and DC charging efficiency from a source that is not clear (the EV-database.org website shows information on vehicle efficiency of travel, not charging efficiency)

• The DC chargers aren't necessarily new, but are different and more efficient than the more predominantly available and used AC chargers.

Project Readiness

Average Score: 8.75 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide additional level of detail in project scope regarding methodologies to allow for better sense of actual scope and ensure validity of results. Project outlines the creation of a test-bed environment that would simulate a typical EV and the charging technologies to be tested. The plan should outline how this testbed environment may different from real world conditions and/or how the project team aims to recreate real-world charging conditions or account for those differences. For example, length of cable or ambient temperature of equipment/battery, or other battery conditioning procedures employed by automakers may have significant impacts on charging efficiencies.

Feedback

• Project plan is detailed and clear. Project partners are included.

• Project scope is clearly outlined with appropriate staging and process. Some task descriptions could use additional detail. For example, project does not identify how many AC or DC EVSE or representative onboard chargers plan to be tested. Data Analysis section does not provide sufficient detail into the types of analysis planned to compare technology performance. Project notes extensive experience working with EVSE manufacturers but does not provide any further detail on that experience.

• The project had partners identified and the submitters have a lab available.

Stakeholder Engagement

Average Score: 6.25 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

• In addition to identifying how specific stakeholders will be identified, contacted, and encouraged to participate in advisory meetings, project plan should consider vehicle OEMs, electrical contractors, and utility planners as key stakeholders for this research as well.

Feedback

• Project lists stakeholders, and how they will be engaged.

• Good idea to hold project advisory meetings.

• Project identifies one clear stakeholder and lists categories of others; project lists a way they will be engaged (2 advisory meetings) but does not describe how the large groups of stakeholders (EVSE manufacturers and fleet operators) will be identified or engaged/encouraged to participate.

• The project has a list of some stakeholders, and other potential ones. It does have a plan for meeting to solicit input.

Timeline

Average Score: 3.75 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

• Provide timeline estimates for the tasks outlined in the project scope to justify the need for 18 months for a lab testing project.

Feedback

• Project timing seems within industry standard.

• 18 months is within the timeline criteria.

• Project does not provide timelines associated with the outlined tasks or why the project will take 18 months. Without information on the number of components or products tested, it is not easy to

identify why project would take 18 months or why the project could not be completed in a shorter timeframe.

- 18 months is given as the timeline, which seems reasonable for this. However it is unclear how many units will be tested.

Cost

Average Score: 3.1 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Provide additional budget detail to justify the estimated costs.
- Providing more detail on why this project will take 18 months and cost ~$300k would be helpful to justify. How many DC and AC chargers will be tested?

Feedback

- Budget seems realistic and achievable. No cost share.
- No cost share identified. Budget is presented at the topline level without any breakout of materials, labor, or costs per task. Project does not specify the number of products tested or test procedures that would impact or justify the costs.
- The budget estimate of $300k seems high for a lab testing environment of a plug load. It is also estimated at 18 months.

Appendix X Small Medium business HPWH emergency deployments

This project will assess and validate the applicability of plug-in HPWHs in small medium businesses. The objective of the study is to evaluate small medium business hot water demand/draw profiles, align the business needs to the plug-in HPWH capabilities and validate the plug-in technology for emergency replacements.

Fuel-switching from gas water heating to a HPWH often triggers expensive and time-consuming electrical upgrades, including panel upgrades and rewiring when the business is not set up to accommodate a new 240V appliance. Such upgrades can add thousands of dollars to retrofit costs, and the time and expense required pose significant barriers to fuel-switching, especially when a customer is seeking an emergency water heater replacement. The plug-in 120V HPWH technology allows for the usage of existing wall outlets rather than requiring expensive electrical upgrades. TRC will partner with Barnett Plumbing, who is successfully installing 120V HPWHs for emergency replacements in residential applications (a TECH 2023 funded project). We will identify viable sites/business types and install up to 10 plug-in HPWHs in small to medium business applications. The project will collect installation cost data and conduct surveys on customer and installer satisfaction with the new equipment.
This field study has the potential to build credibility and showcase financial benefits for plug-in HPWHs for the small medium business market. Lessons learned from this project can advance market commercialization for this technology to the small commercial market and provide data points for CalTF and IOUs, contributing to absorption of the measure in existing TRMs and allowing faster scaling and commercialization of the technology.

Project Details	
Submitter	TRC
Average score	72.06
Score deviation	13.09
Project ID	1239103159
Technology area	Water heating
Project type	Technology support research
Research type	Field demonstration
Target market	Commercial
Timeframe	18 months
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	No recommendations
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions

Evaluation Category	Results
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	No recommendations
Cost	No recommendations

Criteria

TPM Priority

Average Score: 10 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

Feedback

- 120V HPWH identified as high priority
- Res-duty water heating is high priority, CalNEXT lead tech family.

Technology Transfer and Program Alignment

Average Score: 7.5 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Provide additional detail on existing IOU or statewide programs targeting small business water heating, as well as any available small commercial market data in CA.

Feedback

• Lack of details of small business water heating programs, as well as baseline market data. Most of the data provided is for the residential market.

• Unclear that 10 field sites will yield actionable data.

• could encourage the small/medium commercial sector to participate in existing programs

• There are already active deemed measures for comm HPWH installations for both electric and gas baselines (emergency or not), approved in 2023. The proposed scope would not provide enough valuable information for improving or advancing existing measures/program design or filling knowledge gaps.

Utility and Energy Efficiency Program Benefits

Average Score: 11.25 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Add details on the small business opportunity

• I encourage the submitter to rethink what programs or regulators need to encourage market transformation given existing measures and what knowledge gaps exist.

Feedback

• Lack of definition of the opportunity for small business gas to HPWH conversions.

• better understanding the load shifting potential of small commercial applications of HPWH

• The proposed scope would gather measure costs, qualitative barrier descriptions, and example installations without M&V. While unitary, integrated 120V HPWH need program support and innovation in program delivery, the proposed scope doesn't focus on what is needed by those programs.

Underserved Benefits

Score: 3 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

• Project will use TECH Clean CA to install units. There is an opportunity to recruit those working in DAC/HTR.

Project Clarity

Average Score: 6.875 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• It would be helpful to collect not only electricity and possibly water bills but also to meter the water heater energy use separately to best understand TOU rates for the WH vs. the rest of the bill.

• Two of the most useful, unanswered questions that are alluded to include "pre and post bill analysis to understand operating costs with the fuel switching" and "understanding the small and medium business hot water usage and draw profiles." To do this, there would need to be M&V that includes hot water usage measurement. But the proposal doesn't include any measurement to that end.

Feedback

• Scope is clear.

• It's not clear how the sites will be recruited, nor what could be learned from that process.

• Missing the types of small business to be recruited and geographic area. Are you aiming for a variety of business types?

• Scope is somewhat clear but the most beneficial tasks under the proposed scope are not the focus and do not appear achievable.

Project Innovation / Justification

Average Score: 8.75 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• may want to include some estimates of load shifting potential.

• I feel like there may be a few information gaps that could be addressed with a re-developed study:
1. Measuring hot water draw profiles across some various building types - I'd look into existing research/measures to see if and where this might be needed.
2. Identifying what building types are highest value for targeted program design.
3. Evaluating the energy costs of fuel-switching. This would require M&V in a field demo or modeling based on draw patterns, equip performance, and utility rate tariffs.
4. Innovative program design to test approaches that can address barriers in the commercial, emergency replacement market. Program design that targets the most impactful building types.

Feedback

• Applying 120V HPWH plug-in technology to small business is an unmapped opportunity.

• This project uses only 120V WHs targeting small businesses, both have less studies/data and will be useful to learn more about. It will be interesting to see the costs and energy savings.

• I don't see differentiation between the proposed technology and existing measures. Existing measures cover 120V HPWH models and apply to any type of install (emergency or not). Scope wouldn't add enough value to existing measures/programs.

Project Readiness

Average Score: 9.4 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Unclear if the partner already has current small business customers that might be a source for installs

• What is the plan for recruitment, relying on small businesses that reach out to partner contractors? Do you plan to compensate participants, how will get ensure survey participation?

Feedback

• Identifies contractor partner to identify small business opportunities and install HPWH

• 18 months may be a tight timeline. The time to identify and recruit participants is hard to predict.

• Project team appears ready and able to complete the proposed scope.

Stakeholder Engagement

Average Score: 7.5 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Increase level of details on stakeholders.
- would be great to see more stakeholders identified who work with HTR populations

Feedback

- Additional targeted stakeholders outreach might strengthen this proposal (e.g. manufacturers, small business orgs, TECH)
- Some groups of stakeholders are identified, relevant to the proposed scope.

Timeline

Average Score: 4.4 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

Feedback

- same concerns with timeline above, would be great to have a few leads on participants
- 18 months seems about average for delivery of 10 commercial installs and the parallel product/market evaluation.

Cost

Average Score: 3.4 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

Feedback

- As the evaluation is limited to non-metered, data gathering, this budget seems a little high for 10 sites if incentives are available through other programs.

• Cost is too high for proposed scope. Installation costs are likely around $50k, total. $350k is too much for proposed scope and the value it would provide to programs and market knowledge gaps, especially without any M&V beyond billing analysis.

Appendix Y Thermal Energy Storage for Refrigeration

Our proposed project focuses on field demonstrations of Thermal Energy Storage systems that employ Phase Change Materials (PCMs) to reduce both energy and demand of low and medium-temperature refrigeration systems. Thermal Energy Storage systems allow energy-intense refrigeration equipment to be disabled during times of high electrical grid stress, and then reenabled during off-peak hours when electricity is more affordable, and these systems run more efficiently. During peak periods, the pre-cooled PCMs undergo phase transitions that absorb substantial amounts of thermal energy while holding temperatures constant. This provides stable temperatures within refrigerated spaces for extended periods—over 8 hours—without the need for energy-intensive cooling equipment. Essentially, adding energy storage allows refrigeration systems to act as a long-duration battery, providing a cost-effective, behind-the-meter solution for demand and energy management.

Project Details	
Submitter	Michaels Energy
Project ID	1194801963
Technology area	Process loads (commercial, industrial, agriculture, water)
Project type	Technology support research
Research type	Scaled field deployment
Target market	Commercial
Timeframe	12 months
Funding request	Up to $300,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project not a good fit to provide DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• Connect the project more clearly and directly to the Opportunities and Barriers for the High Priority TPM Priority Area, Refrigeration, Commercial. Explicitly state and describe how this project can support, promote, or facilitate conversion to low GWP refrigerants, while also emphasizing energy efficiency, decarbonization, and any other applicable key needs described in the Opportunities and Barries sections of the Refrigeration, Commercial TPM Priority Area.

Feedback

• Commercial and industrial refrigeration which are high and medium priority, respectively.

• Commercial refrigeration is a high priority and mentions scalable thermal energy systems which is inline with this project. However, the Refrigeration, Commercial TPM is clearly focused on low-GWP transitions which is not in scope of this project.

• The proposal aims to reduce energy costs by shifting refrigeration loads to off-peak hours.

• This project aligns well with TPM priority areas but can do more to clearly address the key needs described in the Opportunities and Barriers sections of the Refrigeration, Commercial TPM Priority Area. Scalable thermal storage systems is mentioned as part of the TPM Priority Area Definition, and the project in question touts significant increases in efficiency for refrigeration systems; but the Refrigeration, Commercial TPM Priority Area is also generally concerned with supporting the transition to low GWP refrigerants.

Technology Transfer and Program Alignment

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• PCM holds a lot of promise, but technology adoption has been slow. Recommend including a discussion about how the results of this project will be communicated to the market and how it will be used to inform future work.

• Focus project on developing deemed incentive programs for smaller businesses such as restaurants that are not going to go the SGIP route.

• See the Technology Transfer and Program Alignment Review Criteria and connect the outcomes of this project to that criteria, or one of the criteria examples, more clearly and specifically (e.g. eTRM measure creation, case study development, etc.).

Feedback

• Good DSM potential, supported by SCE demonstration project report

• Identifies custom programs on technology transfer but need more details on next steps such as case study deployment, measure creation

• Proposed technology works well with DR and TOU responsiveness, but unclear as to the path forward for technology transfer.

• Already established. Self-Gen Incentive Program (https://www.selfgenca.com/) available across state already that provides funding for TES such as Viking Cold Solutions TES https://www.greentechmedia.com/articles/read/storing-energy-in-the-freezer-long-duration-thermal-storage-comes-of-age

• This project does not seem to address a plan for tech transfer and partners lined up to do so.

Utility and Energy Efficiency Program Benefits

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Clarify whether the energy savings are load reductions or shifted loads, or whether it includes the energy to recharge the systems. Include details about system operation - temperature range of the PCM, configuration and size of the PCM, time to charge and discharge systems, temperature fluctuations of the refrigerated products, etc.

• Provide resources and links to previous studies to justify 15% reduction in energy with TES.

• Focus scope of project on less established sectors listed including hospitals and restaurants for TES savings.

Feedback

• Energy savings estimated to be 15% and 2 MW, but doesn't discuss the specifics of how that will be achieved.

• Technology has substantial load shifting capability and is big demand response resource for utilites. Energy efficiency and savings from TES technologies are rare.

- Proposed technology works to directly remove refrigeration loads off the grid during peak times.
- Savings have been documented and solutions exist for refrigerated warehouses and grocery stores. Private TES industry is mature either with physical TES or virtual battery through the cloud
- This project has very strong benefits to the utilities and energy efficiency programs as it has the potential to demonstrate significant demand-response capabilities, increased energy efficiency, load flexibility, and/or other beneficial grid interactions (e.g. dispatchable DER).

Underserved Benefits

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

- Provide details about potential test sites - industry, refrigerated space size, temperature applications, product types, PCM installation locations
- Clarify scope of the work by the defining the boundaries of the stated technology in terms of size and applications
- As good as TES looks on paper, would like more details on how the system reverts to a "ready" phase during the off periods.
- Be specific, what TES product are you planning to install, what demand response technology or virtual battery are you deploying for each segment and for each type of equipment, which utility you are collaborating with that has dispatchable DER?

Feedback

- Proposal indicates 4-8 test sites, but doesn't identify any site or market specifics
- No detail on the technology, size, and the type of sites the technology is best suited.
- Proposal claims a gain of efficiency by 10-25% by shifting refrigeration to times of day that have cooler ambient temperature, but does not seem to mention the energy required to "restore" the TES system to be made ready for the next cycle.
- Field deployment goals are stated, No pre retrofit monitoring of refrigeration equipment in scope. How are you measuring savings? Low hanging fruit has already been captured using TES in cold storage facilities and lesser degree in groceries. The criteria that you will select the best sites doesn't help demonstrate the use of the technology in harder to reach segments with lower financial feasibility. It has already been demonstrated in the best sites in the last five years.

• Project scope and objectives are generally defined. Expected outcomes are more tied to the project results (savings for the customers) and not supportive toward larger program objectives, next steps, etc.

Project Innovation / Justification

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide comparison with current technologies such as viking cold storage solutions and other studies related to TES in refrigeration

• Focus more on the longevity and materials of TES vs incumbent battery alternatives.

• Work on a lot of other barriers to adoption, such as fear of product spoilage. Research results are publicly available for best case scenarios, focus your justification on hard to reach segments and be specific where there are no current studies. There are lots of studies available online, Section 10A should offer a much longer list of studies.

• Focus this demonstration on less typical sites, such as hospitals, and emphasize how this characteristic makes this demonstration unique. Review previously completed demonstrations for PCM TES technology, introduce new angles or differences in approach, application, and methodology; emphasize these differences and describe how they will drive investigation/research around PCM TES systems forward. Provide detailed information on energy savings, demand savings, and carbon savings. Show detailed calculations and describe how calculations were made. Provide some background research information in the Project Entry Form to validate values, calculations, and expected outcomes.

Feedback

• Proposal doesn't really include any specifics about the proposed technology. Is it a pallet, a ceiling mounted system, a wall mount, a storage container?

• No clear distinction how the proposed technology differ from existing thermal energy storage solutions for cold storage currently in the market. Not enough background work performed and only two sources cited in a area with lot of past and ongoing research.

• This seems to be a different flavor of the various battery / locally stored electric energy to off-set grid load. Using phase change as a thermal transfer mechanism is the differentiating factor, but the concept overall seems familiar.

• Where is the innovation? Not demonstrated how this research is different than past and present research widely available from Viking, Axiom and others. Payback has already been documented in 2 years, demonstrating it 3 years is not innovative. Not substantiated through links to recent studies in section 10a that an energy savings of 10 to 25% is possible by shifting energy use.

• Beyond the targeting of less typical sites such as hospitals, the project does not clearly indicate significant differences from incumbent technology and/or research. The project provides limited information on energy and demand reduction estimates, as well as limited financial information (e.g. expected demonstration payback). No information is provided regarding carbon reduction estimates and the project appears generally similar to previously completed or in-progress research projects/demonstrations.

Project Readiness

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Include details about the recruitment plan and potential customer sites.

• Provide details on the target sites that will be ideal for this project.

• Expand on the TES technology that will be installed in the various types of facilities. Be specific which facility types will likely receive physical TES, and which ones will be virtual only.

• Detail partners or potential partners further. Provide specific detail on each partner's roles and responsibilities. Provide details on how partners will collaborate (e.g. weekly meetings, expected personnel/titles representing partners, will partners meet in the field? etc.)

Feedback

• Proposal lacks details about customer sites and technology applications.

• Partners have been identified but the project has not identified the type of sites and size of TES solutions that can be deployed

• See comment on timeline. Also, 120 days for installation and commissioning seems high?

• I see virtual powerpant partners. No TES partner, no clients mentioned.

• The project includes good detail regarding how it will be delivered (e.g. scope, site reports, project-level report, etc.) and specifically identifies partners that will be leveraged. Information indicates that the project has a moderate chance of success within the estimated budget/timeframe due to breadth of the scope. The budget and timeframe seem ambitious.

Stakeholder Engagement

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Recommend including an outreach component of this project to interview customers about their perceptions of PCM - the risks, benefits, costs, and limitations
- Quantify economic benefits for customers from demand charges and utility tariffs to get better engagement
- Expand on stakeholder engagement in proposal
- Breakout and establish a comprehensive list of stakeholders in a central location in the Project Entry Form. Detail how each stakeholder will be impacted by the project or project work. Provide a detailed plan for how each stakeholder will be engaged during the project.

Feedback

- Funders and utility partners are noted, but doesn't identify any potential customer sites
- Needs more detail on key stakeholders for businesses and utilities that will benefit from the results of the project.
- The types of end users are clearly identified, but specific customers within the identified sectors are still nebulous.
- A report will be written but further stakeholder engagement to disseminate project results are not mentioned.
- Project generally describes and/or lists stakeholders as aggregators, businesses, utilities and site owners. Only site owners are explicitly detailed in terms of how they will be engaged. Aggregators are very roughly detailed in terms of engagement. Businesses and utilities are not detailed with respect to engagement. Stakeholders are not identified in a central location in the Project Entry Form.

Timeline

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Add details about recruitment plan and installation timeline. Include details of data analysis of weather normalization and operational changes to justify the 3 month monitoring period.

• 3 months of monitoring is not enough the validate the demand response and especially energy savings potential. Consider adding another 6 months to capture seasonal variations.

• Provide further justification that 12 months is appropriate in the Project Form, or extend timeline up to 6 months for additional data capture/buffer.

Feedback

• Seems reasonable if submitter has potential customer sites identified

• Timeline for monitoring need to happen for longer than 3 months to showcase energy savings over various weather conditions

• The timeline provided seems to compress the actual measurement and verification period to a span of a quarter, which may cause the study to miss the impact of different ambient temperatures and the efficacy of the proposed system throughout the year.

• Seems short especially on recruitment and contracting and M&V study time

• Project is specified for 12 months with only 3 months of Instrumentation and M&V. Recommend extending to 18 months for additional data capture opportunity and to allow for buffer in the event project delays are incurred. The timeline appears ambitious and additional time may provide relief.

Cost

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

• Include cost breakdown details. How much will it cost customers? What is the project cost per site?

• Use the currently deployed field projects and cut down costs from recruiting and installations while focusing on the M&V to showcase energy savings and demand response.

• Provide detailed breakdown of budget as much as possible. Identify and detail potential cost share options further (DRET?). Quantify or attempt to quantify cost share expected. Quantify or attempt to quantify potential incentives.

Feedback

• Seems a bit high for potentially only 4 sites

• If the project has already been field demonstrated, why not monitor the current field deployed sites and demonstrate the savings at a much lower budget?

• Need to be specific on how many sites will be virtual deployment only and how many sites TES will be installed.

• Budget estimate appears ambitious but generally aligned with the program expectation. Potential cost share is mentioned but not detailed/quantified. Potential incentives are mentioned but not quantified.

Appendix Z Total System Benefit (TSB) Market Research: TSB Implications for EE programs and emerging technologies

Total System Benefit (TSB) is a new goal metric for EE programs authorized by CPUC decision D.21-05-031. As the name implies, TSB takes into account more than just kW, kWh, or therm savings and will be replacing these legacy metrics starting in 2024. TSB is measured in dollars and is intended to transform the portfolio to align with more complex statewide goals such as demand flexibility, electrification, and refrigerant emissions that are not captured by the simpler kW, kWh or therm savings metrics.

As the portfolio has been preparing for this shift, there is need to support program administrators with the knowledge and tools to proactively adapt current program offerings to this new metric. Calculating TSB is a complex task requiring the use of a variety of cost-effectiveness calculators which make it difficult to intuitively understand which measures bring the most value to the portfolio under the new system.

Second, while TSB will better represent the economic benefits to the overall system (ratepayers, utilities, and environment), there are some misalignments of the value of these measures at the consumer level. For example, it is possible that within a specific heat pump program, for some measure deployment sites with good TSB, the participant cost test (PCT) may not be favorable. The intended outcome of this research is to help Program Designers and Implementers establish program designs that maximize customer adoption of high TSB measures, with the specific leverage point of maximizing PCT to drive demand.

Project Details	
Submitter	Energy Solutions
Average score	65.19
Score deviation	22.16
Project ID	1237930434
Technology area	Whole building
Project type	Technology support research
Research type	Market characterization/study
Target market	Residential
Timeframe	9 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions

Evaluation Category	Results
Utility benefits	Project improvement suggestions
Underserved benefits	Project has clear DAC/HTR benefits
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	No recommendations
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	No recommendations

Criteria

TPM Priority

Average Score: 5 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- Give more detail on how this provides value beyond process evaluations already occurring.

Feedback

- Project does not align with TPM and the justification is not strongly compelling for why it should be a priority. Proposed research should be already covered by process evaluations conducted by a 3rd party EM&V contractor or a program designer.
- While it is not a technology mentioned in any TPM, it will affect all measures and programs going forward.
- TSB will impact all measures in the TPM and understanding impacts on various TPM priorities will help improve TPMs for coming years
- Project does not align with TPMs.

Technology Transfer and Program Alignment

Average Score: 12.2 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

Feedback

- Project is well positioned to be integrated into the EE portfolio of programs as it is intended to aide program administrators and program designers.
- TSB is already planned to be required for programs starting 2024.
- TSB is positioned to be used in program design and evaluation. However, CalNEXT goals do not align with this course of research.

Utility and Energy Efficiency Program Benefits

Average Score: 13.125 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Suggest limiting TSB analysis for measures of high priority in TPMs as opposed to a broad study across all programs. Each PA and implementer is already doing these analyses for themselves.

Feedback

- Project has defined clear benefits to utilities with emphasis on Total System Benefits (TSB) and how to accelerate the integration of TSB into program design.
- While the project idea is timely, it lacks a specific focus on ET measures.
- EE program designers and evaluators do need to look at programs and measures in TSB terms. Workpapers, TRMs, and software tool outputs will likely incorporate TSB over time independent of CalNEXT influence.

Underserved Benefits

Score: 3 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

• Project will use TECH Clean CA to install units. There is an opportunity to recruit those working in DAC/HTR.

Project Clarity

Average Score: 6.25 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Provide needed detail.

• Would be good to identify some high priority measures and give an idea of the depth of analysis

• See comment above

Feedback

• Project has somewhat clear scope and expected outcomes, but is lacking sufficient detail. The project outcomes do not articulate the project's quantitative impact, and the scope of work does not clearly defines how that will be researched, substantiated, or achieved. For example, which and how many personnel designing and implementing programs will be interviewed. How will interviews be conducted and what level of depth is targeted? How will CEDARS be examined?

• See comment above

• Not clear how project team would analyze the existing measures and programs for TSB prioritization. Scope and outcomes are somewhat clear.

Project Innovation / Justification

Average Score: 5 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• TSB only addresses the benefit side of the equation. Programs would still need to meet TRC. That challenge is not addressed in scope.

Feedback

• As mentioned before, there is not a clear difference in this research from standard Process Evaluations provided by EM&V contractors or work that a program designer would already be undertaking.

• TSB vs PAC is a unique perspective necessary to be addressed. However, the project as proposed does not address TSB vs TRC.

• The TSB metric will be looked at by program designers and evaluators regardless of CalNEXT program influence.

Project Readiness

Average Score: 6.875 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

Feedback

• The Project has good, but vague, information about how it will be delivered. It has not identified partners nor contacts to be interviewed. Information indicates that the project has moderate chance of success within the estimated budget and timeframe.

• Only the project lead is identified with no explanation of partners or expertise in the context of the proposed scope. There is little explanation of how the scope will be achieved.

Stakeholder Engagement

Average Score: 6.25 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Could use more detail on tech transfer to maximize the impact of the results.
- Suggest engaging with CalTF and their MSC as a starting point instead.

Feedback

- Project describes who stakeholders might be but does not describe how they will be engaged.
- The scope identifies interviews with program implementers. They may not always be in a position to provide specific inputs due to contractual or IP related issues.
- Stakeholders are only identified as "program designers and implementers."

Timeline

Average Score: 3.75 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Should be able to shorten to 6 months given the scope.

Feedback

- Project timeframe estimates are close to being within the industry standard timeline given the scope and expected outcomes.
- The timeline is appropriate for the amount of work to be done. However, worried about the impact of the study since TSB will already be in place before this study begins.
- Timeline seems typical for the proposed scope.

Cost

Average Score: 3.75 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

Feedback

- Budget estimates are realistic and aligned with the program expectation.
- Budget could be high depending on depth of analysis and deliverables provided.
- Cost difficult to determine for the TSB assessment of measures in eTRM and CEDARs database. Otherwise, qualitatively discussing measure types and program ideas in the context of TSB would not justify the proposed budget.

Appendix AA Transpiration Only Irrigation

Transpiration only irrigation is a path to reduce water and energy use on farms by 80%. The remaining 20% of energy needed for farm pumping is a highly flexible load, that can be call on for renewable energy spikes or periods of overcapacity. The project creates a path to carbon negative agricultural industry and a state wide renewable energy grid tool for grid grooming.

The impacts are great across California as agricultural water uses 70% of all freshwater resources in California, at the same time it is estimated "Approximately 19% of the net energy use in California is associated with the sourcing, conveyance, treatment, distribution, end-use, and disposal of water. Approximately 7% is associated with transmission, distribution, and pressurization of water" – CalNext website.

Project Details	
Submitter	Umida Agriculture
Project ID	1195214626
Technology area	Process loads (commercial, industrial, agriculture, water)
Project type	Technology support research
Research type	Tool development/enhancement
Target market	Agricultural
Timeframe	12 months
Funding request	Up to $400,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	No Suggestions
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

- Energy savings result from reduced pumping energy, but project doesn't effect pumping systems, technologies, or efficiencies. Focus proposal on connection to water systems.
- I don't see a big worry here, but a stronger focus in the narrative in water systems and energy savings could help push this to 100% water systems TPM alignment.

Feedback

- Project most closely aligned with water systems, which is a medium priority. Proposal mentions pumping systems, but project doesn't interact with pumping technologies.
- Process Loads/Water Systems - priority medium
- I see it cross cutting two process loads priority areas: Pumping Systems and Water Systems. However, it's not 100% in alignment since the technology is focused on reducing pump needs rather than providing a new pump tech.
- Improving irrigations efficiency helps the CA reduce water consumption, saves pump energy and and helps CA achieve its ground water management goals.
- Water pumping for agricultural use fits within the Process Loads TPM under Water Systems and seems to address the opportunities and barriers sections.

Technology Transfer and Program Alignment

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Include details on the broader application of this technology - to other crops, topographies, climate zones, soil types, etc.
- Suggest adding more specificity on the project and how technology transfer will occur.
- This technology should be looked at in terms of Total System Benefit (TSB). The best pathway my be New Measure Package Development, verified based on field studies which could be conducted as part of the CalNEXT study.

Feedback

• Water and energy savings in agriculture is a market with large EE and decarbonization potential, but high variability and low market adoption. This project seeks to provide additional data to inform the future work.

• Unclear. Who are the "Utility Stakeholders" and how will they be engaged?
Need some detial on the next steps after this project that will use the energy and water savings information in utility efficiency programs.

• Although this projects supports energy efficiency around the Water / Energy nexus and there are programs that focus on water savings, it's not clear how this project will help with technology transfer to the CA IOU EE portfolio. The quantification of savings is a start, but how will this technology ultimately be supported in an EE portfolio? Would this be deemed savings, custom savings, NMEC measured savings?

• Do to various pump operations, weather conditions and crop rotations, EE/DSM programs struggle to verify irrigations efficiency savings. The claimed savings seem very optimistic. The recommend pathway for technology transfer is On-Bill Financing. OBF would require population based NMEC, for which irrigation pump systems would not be a good candidate.

• Though this project could inform a future program design, tech transfer specifics are not described. Stakeholders related to this are not mentioned.

Utility and Energy Efficiency Program Benefits

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

• How do the energy savings change if gravity-fed systems are not an option?

• Expand on the reduction in pumping times and how pumping times can be matched to low TOU rates / times when renewable generation are at peak. Add more detail on how grid flexibility benefits will be measured.

• If this technology can be shown to reduce energy and water consumption as reported, it could be the next step in irrigation efficiency moving beyond micro sprinklers and drip irrigation techniques.

Feedback

• Propject proposes 80% reduction in pumping energy when gravity flow is used.

• EE and load flexibility

• The proposal makes allusions to correlating energy savings with reduced water use, but only touches upon it rather than doing a deeper dive into the how's and why's.

• If 80% is achievable and verifiable, it would clearly benefit utility EE and load management programs given the number of pump systems in the Central Valley and throughout CA. However, reviewing a website that appears to match this technology, savings claimes are reported to be 20-50%.

• The project could benefit utility programs designed around on-bill financing and load flexibility.

Underserved Benefits

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Project Clarity

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Provide additional details about the scope of the project and what will be done to achieve the goals. What data will be collected, how will savings be measured, what is the baseline, what components will be utilized? Proposal mentions many options for design flexibility and financing opportunities, but doesn't specify what this project will include.

• Add detail to the scope so that reviewers understand the full details of the project. The scope is lacking sufficient detail for a funding request of $400,000.

• The project scope and input needs clarification. The estimated savings of 80% may be unreasonable.

Feedback

• Proposal doesn't really describe the scope of the project, just focuses on goals.

• Project description needs to give more details on what transpiration irrigation is and how it would be achieved.
- deliver irrigated water four feet below the surface in a large pipe
- soil capillary action draws water upwards to plants
Field demonstration on a 20 acre California almond orchard and a 20 acre California alfalfa field.

• The project scope section is light on detail. How many sites will be included in the study? Will some of the funding be used for the equipment, and if so, how much? How will energy savings be measured? How will grid interactivity be measured? On-bill financing is mentioned, but there is no description of how this will be incorporated.

• The technology is I not clearly described. Technology described on the web (https://umidaag.com/) more clearly defines and presents the idea of Transpiration Only Irrigation.

• The details provided in the scope are limited. The outcomes section indicates energy conservation will be quantified and the benefits to an on-bill financing program.

Project Innovation / Justification

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• Suggest including a review of the barriers to this technology. It seems to require heavy field modification to install the V-groove trenches. It's not clear what the limitations for installation are or what types of irrigation and crops this is applicable for.

• Project indicates moderate to strong differences from incumbent technology and/or research and is not similar to completed or in progress research projects. It has limited information on energy, carbon, or demand reduction estimates but includes some calculations and research on this as part of the project.

Feedback

• Water savings are evident and project has good TSB, but energy savings are not well defined.

• Clear energy and water benefits

• The project is novel and innovative, with very clear saving claimed for water (80% reduction), but clearer links need to be made for energy and demand reduction estimates. For instance, what is the baseline utilized for the 80% reduction claim? How does drip irrigation compare to this technology? An analysis of potential barriers would also be helpful in understanding the total potential impact of this technology.

• The proposal claims an 80% reduction in irrigation losses. However, it is unclear what the baseline is. It seems to suggest irrigation flooding as the baseline. It is not clear how this technology would compare to micro or drip irrigation

• The project's technology is innovative in its approach to irrigation as compared to current technologies in use today. Energy impacts are not described but are part of the scope.

Project Readiness

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

- How does the project priorities and timeline shift if it can't begin by December 2023?
- Need more detail on how the water and energy savings will be measured.
- Include description of analysis within the scope.
- Project indicates moderate to strong differences from incumbent technology and/or research and is not similar to completed or in progress research projects. It has limited information on energy, carbon, or demand reduction estimates but includes some calculations and research on this as part of the project.

Feedback

- Project partners are identified and timeline is outlined, but there is a lot of risk if project can't begin by December 2023.
- Clear plan and identified two sites.
- Pathways and project partners are clearly defined, but analysis methods for energy and demand savings are undefined.
- The technology is mechincally simple and readily deployable. Measure EUL reported on the website is questionable.
- Given the somewhat vague scope of work and key partners lined up, it is uncertain this project is ready.

Stakeholder Engagement

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- As this project proposes a very different operating profile for water distribution systems, a closer look should be had at systems that are more suited to intermittent use rather than continuous duty cycles.
- Project lists stakeholders but does not describe how they will be engaged as part of the project

Feedback

- Project partners are identified, but doesn't describe broader market engagement or plan for technology transfer
- Who are the "Utility Stakeholders" and how will they be engaged?

- Stakeholders seem to be listed as primarily water-intense agricultural customers, but little is said about the pump manufacturers.
- Two farms are referenced and little else describing the engagement is provided.
- The project proposal has limited information about stakeholders and how they will be engaged.

Timeline

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- 100% Project timeframe estimates are shorter than the industry standard timeline given the scope and expected outcomes and there is strong indication that the timeframe will be met.

Feedback

- Time to complete project seems reasonable.
- might need more time
- 12 months to capture a growing season is reasonable.
- The project will require a full year of pre- and post-irrigation data.
- The proposed timeline is reasonable for a field study.

Cost

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Are there other funding sources that support projects with water savings and agricultural innovation? Cost estimate seems high for 2 installations. Provide cost breakdown details, including estimated cost per farm for project materials, labor and installation, cost savings, etc.
- Include enough detail that reviewers will understand what the funding is being used for and how much the system costs per site.
- Additional information regarding the project scope and cost should be provided. Study costs should be clearly described and itemized

Feedback

- Seems high for 2 installations
- Capped at $300k
- There is not enough detail in the scope to justify a $400,000 budget.
- There are few details describing what the $400,000 budget covers. The reasonableness of the project cost could not be assessed because the overall scope including project size (acres impacted), M&V, and pre & post analysis were not included.
- The budget seems realistic, but no cost share is provided.

Appendix BB Wastewater Energy Transfer Technology Feasibility Study

This market feasibility study focuses on assessing the viability of a Wastewater Energy Transfer (WET) system program intervention using wastewater heat recovery technology. The objective is to understand the market potential and practical applications of wastewater heat recovery technology in new construction and retrofit projects across various building types, including but not exclusive to multifamily residential, commercial laundries, food production facilities, hospitality, senior living, and healthcare facilities.

The technology is a specialized water to water heat pump that recovers energy directly from wastewater and uses this source energy to produce hot water up to 140°F. Typically used for potable domestic hot water purposes, this technology can also be used for hydronic heating or other hot water process loop applications. Given its completely sealed system design, WET systems are designed to work with black or grey water in occupied buildings, with no concern of odors or cross-contamination with the fresh water supply.

As a fully electric system, this technology can support a fully electric water heating system for buildings traditionally served by fossil fuel heating sources. This feasibility study is intended to demonstrate how a wastewater heat recovery system compares to other thermal energy technologies, and in which building types and market sectors it best aligns throughout California.

Project Details	
Submitter	Energy Solutions
Average score	60.81
Score deviation	4.83
Project ID	1238939827
Technology area	Water heating
Project type	Technology support research
Research type	Market characterization/study
Target market	Residential
Timeframe	9 months
Funding request	Up to $200,000

Evaluation Category	Results
Technology priority maps	Project improvement suggestions
Technology transfer and program alignment	Project improvement suggestions
Utility benefits	Project improvement suggestions
Underserved benefits	Project could be a good fit, if Ortiz group feedback is incorporated into the Project Plan

Evaluation Category	Results
Project clarity	Project improvement suggestions
Project innovation/justification	Project improvement suggestions
Project readiness	Project improvement suggestions
Stakeholder engagement	Project improvement suggestions
Timeline	Project improvement suggestions
Cost	Project improvement suggestions

Criteria

TPM Priority

Average Score: 6.875 out of 10

Category Description – Project objectively aligns with the current CalNEXT Technology Priority Maps (TPM) priority areas.

PROJECT IMPROVEMENT SUGGESTIONS

• Because this project may address water heating in both residential multi-family buildings and commercial buildings, this project may also be well-aligned with the Residential-duty water heaters technology area and the Commercial-duty water heaters technology area, both of which are also within the Water Heating TPM. Both of these additional technology areas are high priority. In terms of barriers for these additional technology areas, this project may address education and training, and may provide the following; sector-specific knowledge; data on energy savings potential, and general feasibility awareness for heat pump water heating. Although novel in approach, this project will work to expand knowledge on what is possible/feasible and should generally work to promote adoption of heat pumps for water heating applications. With this in mind, try to pivot the TPM alignment of this project to emphasize stronger connection with these high priority technology areas, over the medium priority technology area of Alternative Design Strategies. Maintain connection with the medium priority technology area of Alternative Design Strategies as a secondary association. Ultimately though, if a strong case for high priority connections can be made (along the lines described above), full credit in this project criteria category is more likely to be granted.

Feedback

• Drain water heat recovery is identified as an area for future work in the WH TPM alternative designs. However, not a high priority.

• Water Heating TPM under the Alternative Design Strategies - medium priority, addresses barrier

• The project clearly aligns with the Water Heating TPM under the Alternative Design Strategies technology area. Alternative Design Strategies is a medium priority technology area. Within Alternative Design Strategies, this project will address the barriers of "lack of experience deploying of drain water heat recovery, particularly with the variety of potential heat sources". This project may also address the barrier of "lack of experienced practitioners in alternative strategies" by potentially providing increased education and knowledge around what is possible for domestic hot water heat pump system design. Because the Alternative Design Strategies technology family is only medium priority (rather than high priority), only half credit can be given for this project criteria category at this time.

Technology Transfer and Program Alignment

Average Score: 8.4 out of 15

Category Description –Project is well positioned for integration into existing utility EE/DSM portfolios. The project establishes a market and/or a direction for utilities to take to continue researching the technology or designing incentives for customer adoption. The project exhibits real potential for impact savings and has enough technical or market maturity to fit utility programs.

PROJECT IMPROVEMENT SUGGESTIONS

• Provide details on technology, savings and any other existing studies.

• Please include potential/estimated energy impacts supported by reference if available

• Clearly and specifically identify a Technology Transfer pathway that this project will address from the Technology Transfer categories listed online. Describe in greater detail how this project aligns with the identified pathway. Develop a Technology Transfer plan and describe the steps this project will take to fulfill that plan. Explain in greater detail how the results and data from this project will directly feed into the next steps for a given Technology Transfer plan. Expand on the demonstration of incentive layering that this project will illustrate. For example, discuss how the incentive layering demonstration can relate to existing measures/measure packages and potentially further measure package development.

Feedback

• Although the proposal provides general details on the WET technology and opportunity, there are no references to other studies on the technology to quantify the opportunity.

• Significant barriers to adoption are likely to limit technology adoption

• Energy or carbon impacts are unclear and market maturity is unclear. The proposal claimed the technology has saving potential without any supporting data or reference.

• The project is likely in good position for integration into a new or existing measure package, or to generally scale the adoption of a technology (e.g. heat pump technology for water heating). A demonstration of incentive layering is mentioned but not well developed with respect to Technology Transfer. There is also mention that this project does not include a measure package development component, but that the energy analysis data collected may be able to inform custom savings calculations in support of a deemed savings methodology. Although these ideas are cited,

they are only stated very generally, and without high confidence. A Technology Transfer pathway is hinted at but not explicitly named, defined, clarified, described, or developed.

Utility and Energy Efficiency Program Benefits

Average Score: 10.3 out of 15

Category Description – Project has defined clear benefits to the utilities (EE, load flexibility, and/or grid interaction) and energy efficiency programs.

PROJECT IMPROVEMENT SUGGESTIONS

- Provide details on technology, savings and any other existing studies.

- Provide further detail on key benefit terms and concepts, especially Total System Benefit and overall system benefit to the grid. Describe in detail how exactly this technology will contribute to Total System Benefit. Describe in detail how this technology will specifically enable lower energy consumption. For example, load shifting is mentioned, but it is not described, nor is it exactly clear, how this technology will support load shift programs. Load reduction is intuitive to imagine but load shifting requires more detail to visualize. Recommend also adding details regarding the lifecycle of the technology (e.g. lifecycle kWh savings) and creating a centralized section (in the scope of work) that discusses all technology benefits at once, rather than mentioning different benefits throughout different sections. Finally, strongly recommend putting at least rough ballpark numbers to building types (e.g. roughly how many multifamily residential buildings with 50 or more units exist in the US?) in order to emphasize how widespread benefits from this technology may become.

Feedback

- As above, more details on the actual opportunity would improve the proposal

- No estimate of how much more efficienct this system would be than air to water heat pumps. Electrification benefits clear. Unclear how load shifting will happen unless there are expensive and maintenance intensive waste water tanks added

- Characterize the potential benefit and cost effectiveness of waste water heat recovery is a useful exercise to help inform program measure development

- The project mentions key benefits such as electrification, decarbonization, and reductions in energy consumption (i.e. energy savings). The project also briefly mentions Total System Benefit and that it will provide an estimate on overall system benefit to the grid. It can be confidently stated that this project has at least limited-to-moderate benefits to the utilities and related energy efficiency programs. However, given the mention of key benefit terms without significant additional detail/description, it is hard to confidently assume that this project will provide above-moderate benefits. Furthermore, because of the seemingly novel and somewhat specific application that this project outlines, it is difficult to fully understand how easy and/or practical it will be to leverage widespread benefits from this technology.

Underserved Benefits

Score: 3 out of 10

Category Description – This refers to the benefit your project may have to Disadvantaged or Hard to Reach Communities

Feedback

• When assessing the target market sectors as well as the reporting outline, consider including a section on DAC or include DAC as a variable. Using the CalEnviroscreen tool might be useful to show study outcomes in relation to DAC areas.
https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

Project Clarity

Average Score: 3.75 out of 10

Category Description – Project has clear scope and expected outcomes

PROJECT IMPROVEMENT SUGGESTIONS

• Narrow the scope to ensure that a clear market/program opportunity is identified

• This study is proposed as market feasibility study with broad scope and extremely vague data collection and analysis approach. The proposal need to be more specific about the methodology for each expected outcome. For market feasibility, how do you define feasibility for the particular technology of interest. it is not sufficient to say " we will analyze the market data". For energy and cost saving analysis for the technology, the data analysis scope broadly include energy related data from literature review. What data are needed and available for the proposed technology? What are the potential data sources?

• Provide significantly more detail and organization regarding the scope. For example, what data points will be used in the energy consumption analysis? How will the data be analyzed; model, equations, etc.? How will interviews be conducted with architects, designers, engineers, etc.; will there be a questionnaire? How will architects, designers, engineers, etc. be selected and/or engaged? What will be the criteria for technical compatibility for this technology? How will reporting be maintained (e.g. will there be a preliminary report, will there be a draft report, etc.)? Recommend breaking out the scope of work into sub-sections such as "Preliminary Research/Findings", "Analysis of Market Data", "Consolidation of Market Insights", "Draft Report Generation", "Design Feasibility Research", etc. to provide a more organized level of detail. This same level of detail can be generally applied to the Expected Outcomes section as well, in order to achieve a full points score for this project criteria.

Feedback

• The scope of the project might benefit from a more narrowed focus where sufficient data would be available to best characterize the WET opportunity.

• How will the project estimate Total System Benefit? How will energy savings be calculated?

• This study is proposed as market feasibility study with broad scope with extremely vague data collection approach. The proposal need to be more specific about the data collection and analysis methodology for each expected outcome. For market feasibility, how do you define feasibility for the particular technology of interest. it is not sufficient to say " we will analyze the market data". For energy and cost saving analysis for the technology, the data analysis scope broadly include energy related data from literature review. What data are needed and available for the proposed technology? What are the potential data sources?

• The project has a somewhat clear scope and a generally clear set of expected outcomes that are likely achievable. Additional detail regarding how expected outcomes will be ensured, and having expected outcomes broken into short-term and long-term categories, is helpful.

Project Innovation / Justification

Average Score: 8.125 out of 10

Category Description – Project identifies clear differentiators from incumbent technology, including why this project is different from any past and present research. It provides energy, carbon or demand reduction estimates and calculations. If estimates are unknown, the project suggests research in this area.

PROJECT IMPROVEMENT SUGGESTIONS

• Include explicit calculations (or at least descriptions of calculations) that will be required to quantitatively analyze this project. Provide descriptions of key variables. Detail any energy, carbon, and demand reduction estimates/calculations further. Provide more background, or at least some ballpark estimates, for figures related to energy savings. Attempt to lightly quantify the potential reach for this technology. For example, it is understood that this project could impact mutlifamily residential buildings with 50+ units, but how many multifamily residential buildings with 50+ units roughly exist in the US? This type of rough preliminary background info should be made available whenever possible to help illustrate/emphasize the justification and impact that this innovative technology may be capable of achieving. If calculations and estimates are unable to be made, detail further how this project's research will facilitate estimates and calculations.

Feedback

• WET and thermal energy networks are an innovative new solution that could make electrification more economical in CA.

• Need to give some sense of the magnitude of the energy savings that could be expected and the cost increase compared to tear source heat pumps. This technology seems like a better fit for very cold climates where air source heat pumps would have lower efficiency.

• Characterize the potential benefit and cost effectiveness of waste water heat recovery is a useful exercise that has not been done before

• The project indicates moderate to strong differences from incumbent technologies and/or research due to its novel approach/application. The project does not appear to be similar to any completed or in progress research and appears to be somewhat unique for CalNEXT. Limited information on energy, carbon, and demand reduction is provided. No quantitative estimates, data, or calculations are described beyond general statements of energy savings. Energy savings analyses and similar calculations are included as part of the project's research objectives. Overall, this project appears somewhat innovative, but with a justification that may benefit from additional detail.

Project Readiness

Average Score: 5 out of 10

Category Description – Project identifies effective project delivery and leverages appropriate, critical partners. It demonstrates a clear path to completing the project and deliverables within the estimated budget and timeframe.

PROJECT IMPROVEMENT SUGGESTIONS

• Consider moving manufacturer to be a stakeholder, not a critical partner.

• The project scope and methodology need significantly improvement

• Provide more detail with respect to the project delivery pathway. For example, what are the key milestones or stages required for successful project delivery? Provide a list with short descriptions at each milestone/stage (e.g. Market Research, Draft Report Generation, Data Analysis, etc.). How much time will be allotted between each milestone/stage? Provide more detail on exactly what project partners will do, and when they will do it. What are the different roles between partners? What kinds of titles are expected to be involved in project delivery (e.g. design engineer, project manager, building operator, data analyst, etc.)? How will collaboration occur? Will there be meetings; how often will meetings occur? Etc.

Feedback

• Having a manufacturer as part of the project team might raise concerns about bias. Will other manufacturers be involved and if so, should this manufacturer be a stakeholder?

• No review of other past studies on WET equipment

• The project has generally good information about how it will be delivered and has clearly identified partners and/or partner organizations. Information provided indicates that the project has a suitable foundation of subject matter experts and industry professionals and thus should have no major issues achieving success.

Stakeholder Engagement

Average Score: 7.5 out of 10

Category Description – Project lists potential stakeholders and how the relevant stakeholders will be engaged during the project.

PROJECT IMPROVEMENT SUGGESTIONS

- Add target market stakeholders
- Create a comprehensive and more granular list of stakeholders and clearly state stakeholder titles, how stakeholder titles will engage in supporting project outcomes, and how stakeholder teams will coordinate (i.e. a detailed step-wise plan for how stakeholders will be engaged). Define responsibilities by both organization and individual title as much as possible. Relate the stakeholder list to the different project objectives, deliverables, and milestones/stages.

Feedback

- If focusing on a specific market opportunity (e.g. multifamily), consider adding relevant stakeholders for that application type.
- The project team has identified partners and type of stakeholders to engage with
- The project clearly states who the key stakeholders are and/or might be and provides adequate general details on how stakeholders will engage in supporting the project objectives.

Timeline

Average Score: 4.4 out of 5

Category Description – Project timeline estimates will demonstrate results within industry standards and research objectives (i.e. market characterization ~6 months, HVAC pilot 12-18 months to capture seasonality).

PROJECT IMPROVEMENT SUGGESTIONS

- Scope and methodology is too vague to evaluate whether this timeline is reasonable or not.
- Recruit additional partners/support to achieve project outcomes and deliverables in a shorter span of time, or on a broader scale within the same amount of time. 9 months for a feasibility study that includes preliminary design work is appropriate, but if this feasibility study can be achieved in <9 months time, and the improved timeframe is well-demonstrated in the project intake form, then the Timeline criteria will be exceeded and full credit will be granted. Regardless, do not compromise project quality.

Feedback

- Timelines seems appropriate
- Scope and methodology is too vague to evaluate whether this timeline is reasonable or not.
- Given the scope, and that this study goes beyond market characterization and into feasibility (particularly with the potential to produce preliminary system designs), 9 months is appropriate and can be deemed within industry standard expectations.

Cost

Average Score: 3.4 out of 5

Category Description – Estimated budget range is reasonable given the research objectives.

PROJECT IMPROVEMENT SUGGESTIONS

- Consider reducing the budget.
- Refined scope is needed before coming up with estimated budget
- Develop and identify a cost share with a partner, manufacturer, or other outside entity. Describe in specific detail where higher costs may come from (e.g. preliminary system design work?). Investigate specific strategies that allow for reductions in project cost and document them more clearly to demonstrate a strong commitment to the effective use of CalNEXT funding.

Feedback

- Budget seems a little high for a market study.
- Need more clarity on how the technical assessments will be done to justify the budget requested
- Market characterization studies are typically expected to come in around $125k-$150k. Because this study goes beyond market characterization and includes feasibility aspects (i.e. potential to produce preliminary system designs) $200k may be realistic and within reason.