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Economic, Climate, and Health Impacts of Single-Room Heat Pumps in California Homes

Additional submitted attachment is included below.

Electric Program Investment Charge 2026–2030 (EPIC 5)
Research Concept Proposal Form

The California Energy Commission (CEC) is currently soliciting research concept ideas and other input for the Electric Program Investment Charge 2026–2030 (EPIC 5) Investment Plan. For those who would like to submit an idea for consideration, please complete this form and submit it to the CEC by **August 8, 2025**. More information about EPIC 5 is available below.
To submit the form, please visit the e-commenting link: https://efiling.energy.ca.gov/EComment/ECommentSelectProceeding.aspx and select the Docket **25-EPIC-01**. Enter your contact information and then use the "choose file" button at the bottom of the page to upload and submit the completed form. Thank you in advance for your input.

Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

Name: Mary-Ann Rau

Email: maryann@merinoenergy.com

Phone number: 706-615-4376

Please provide the name of the contact person's organization or affiliation:

Merino Energy

Please provide a brief description of the proposed concept that you would like the CEC to consider as part of the EPIC 5 Investment Plan. What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed to support the concept?

Merino Energy proposes a research study to quantify the economic, environmental, and health benefits of single-room heat pump (SRHP) systems in California homes. It will compare SRHPs to gas heating, central heat pump systems, and hybrid configurations, with a focus on low-income households.

The project will also assess the impact of smart, connected SRHP networks and supplemental SRHP use in homes with primary gas heating. EPIC funds will support real-world pilots, performance monitoring, occupant surveys, and cost/benefit modeling to address data gaps that limit adoption of SRHP technology.

In accordance with Senate Bill 96, please describe how the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals." For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technology or innovation? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, provide more information on what data and information gaps the proposed concept would help fill, and which specific parties or end users would benefit from the results, and for what purpose(s)?

The proposed concept addresses the following barriers:

- **Cost barrier:** Many households cannot afford central system replacement but could adopt room-level solutions.
- **Performance uncertainty:** Limited California-specific data on SRHP efficiency and cost savings relative to gas or central systems.
- **Integration gap:** Unclear benefits from coordinated operation of multiple SRHPs in a single home.

- **Equity gap:** Health and quality-of-life benefits for low-income households are under-measured.

Research questions:

1. What are the annual operating cost savings of SRHPs vs. gas?
2. How do SRHPs compare economically and environmentally to central heat pump systems?
3. How does a smart, connected SRHP network perform relative to alternatives?
4. How does SRHP supplemental heating affect primary gas heating use?
5. What are the public health and comfort benefits for low-income residents, especially during extreme climate events, like heat waves?

Targets:

- Energy savings: ≥20% reduction in heating costs vs. gas baseline.
- Emissions: ≥40% CO_2e reduction vs. gas baseline.
- Indoor comfort: measurable improvement in thermal comfort and occupant-reported satisfaction.

Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology or ratepayer costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the innovation at scale? How will the innovation lead to ratepayer benefits in alignment with EPIC's guiding principles to improve safety, reliability, affordability, environmental sustainability, and equity?

Merino Energy anticipates the following outcomes:

- **Economic:** Lower total cost of comfort for households that cannot afford central retrofits.
- **Climate:** CO_2e reductions from gas displacement and higher HVAC efficiency.
- **Grid impacts:** Characterization of SRHP load profiles for potential demand flexibility.
- **Equity & health:** Documented improvements in thermal comfort and indoor air quality in disadvantaged communities.

At scale, SRHP adoption could lower emissions by hundreds of thousands of metric tons annually while improving access to efficient heating/cooling. By providing the answers to the research questions outlined above, the CEC can provide this data to heat pump manufacturers to help them develop and/or market single-room heat pumps to consumers more effectively.

Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

- Annual energy consumption (kWh, therms) pre- and post-installation.
- Annual operating costs vs. baseline.
- CO_2e emissions avoided per household.
- Indoor temperature stability and humidity control.
- Occupant satisfaction and self-reported health outcomes.
- Adoption potential and payback period by housing type.

Please provide references to any information provided in the form that supports the research concept's merits. This can include references to cost targets, technical potential, market barriers, equity benefits, etc.

1. CEC (2021). *Building Decarbonization Assessment*. CEC-500-2021-054. https://www.energy.ca.gov/publications/2021/california-building-decarbonization-assessment

2. Wilson, E. J. H., Munankarmi, P., Less, B. D., Reyna, J. L., & Rothgeb, S. (2024). *Heat Pumps for All?-Distributions of the Costs and Benefits of Residential Air-Source Heat Pumps in the United States*. Joule, 8(4), 1000–1035. https://doi.org/10.1016/j.joule.2024.01.022
3. Gerke, B. F., Gallo, G., Smith, S. J., Liu, J., Alstone, P., Raghavan, S., Schwartz, P., Piette, M. A., Yin, R., & Stensson, S. (2020, July 14). *The California Demand Response Potential Study, Phase 3: Final Report on the Shift Resource through 2030*. Lawrence Berkeley National Laboratory. DOI: 10.20357/B7MS40. This report was prepared for the California Public Utilities Commission. https://www.dret-ca.com/wp-content/uploads/2021/03/ca_dr_potential_study_-_phase_3_-_shift_-_final_report.pdf

The EPIC 5 Investment Plan must support at least one of five Strategic Goals:

a. **Transportation Electrification**
b. **Distributed Energy Resource Integration**
c. **Building Decarbonization**
d. **Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas**
e. **Climate Adaptation**

Please describe in as much detail as possible how your proposed concept would support these goals.

Our proposed concept addresses the following goals:

- **Building Decarbonization:** Supports rapid electrification where full-home retrofits are cost-prohibitive.
- **Distributed Energy Resource Integration:** Smart SRHP networks can provide flexible load.
- **Climate Adaptation:** Improves access to cooling during extreme heat events for vulnerable populations.

About EPIC

The CEC is one of four EPIC administrators, funding research, development, and demonstrations of clean energy technologies and approaches that will benefit electricity ratepayers of California's three largest investor-owned electric utilities.
EPIC is funded by California utility customers under the auspices of the California Public Utilities Commission.
To learn more about EPIC, visit:
https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program
EPIC 5 documents and event notices will be posted to:
https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5
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