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Mass-Market Demand Flexibility with MIDAS

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. We appreciate the opportunity to submit the following idea for consideration.

1. Name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

Karen Herter

Karen at HerterEnergy.com

9l6-397-o1o1

2. Name of the contact person's organization or affiliation:

Herter Energy Research Solutions

3. 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?

Concept. Demonstrate and validate plug-and-play demand flexibility in key appliances – smart thermostats and heat-pump water heaters (HPWHs) – that automatically adjust operation based on MIDAS data feeds. The project will run a large field study in >1,000 low-income (CARE/FERA) single-family homes across one or more high-density, disadvantaged regions in specified climate zones (Los Angeles Basin, Central Valley, Inland Empire, Southern Coastal counties, Bay Area). Every participating home receives a MIDAS-responsive thermostat whose on-board firmware interprets Schedule, CO_2 intensity, FlexAlert flags, and time-dependent price signals to pre-cool/pre-heat and then coast through the evening peak. In a significant subset (100 to 200 homes), the thermostat is paired with a MIDAS-ready HPWH to quantify stacked benefits.

Automation modes such as Schedule, AutoFlex (price/CO_2-aware), and a non-automation experimental control are staggered in a crossover design to provide within-sample baselines. CAISO FlexAlerts further increase load shed during event hours. Devices communicate over customer Wi-Fi; if >25% of early installs cannot sustain ≥95% uptime, the study will trigger an over-the-air contingency that evaluates broadcast and low-bandwidth options such as ATSC 3.0 datacasting and HD Radio subcarriers. This design yields real-world evidence of MIDAS-driven flexibility at scale while minimizing enrollment friction and avoiding utility-specific integrations.

Purpose. Demonstrate at scale that MIDAS plug-and-play appliances respond to continuously varying grid signals to deliver measurable peak load shifting, bill savings, and greenhouse-gas reductions without customer sign-ups or utility-specific integrations; quantify equity value by tracking bill impacts, comfort impacts, and participation; and publish a year-long, high-resolution performance data set and evaluation.

Why EPIC. EPIC funding is critical to support this project's innovative approach to demonstrating plug-and-play demand flexibility in low-income households, which requires pre-competitive research, cross-vendor standardization, and robust field validation. Unlike rebates or utility programs, EPIC can fund essential components like MIDAS-compatible firmware development, equitable outreach, and independent measurement of load-shifting and emissions impacts. These efforts will produce open-access data to guide future grid planning and demand response programs, ensuring scalable, equitable, and sustainable energy solutions for all Californians.

4. In accordance with Senate Bill 96, the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals" as follows:

The pilot directly targets the core obstacles that have stalled mass-market flexibility in California's low-income homes. The table below maps each barrier to a concrete breakthrough the study will demonstrate and document.

Barrier	Breakthrough Potential Delivered by the Pilot
Enrollment friction and low DR participation	Ship devices pre-configured to "listen" for MIDAS – no customer sign-up, app pairing, or utility paperwork – showcasing true zero-touch participation.
Lack of evidence for mass-market appliance flexibility	Demonstrate plug-and-play thermostats and HPWHs responding to standard MIDAS feeds, validating a scalable pathway for California. Produce a statistically robust, multi-year field dataset – not just simulation or lab results.
Lack of CAISO FlexAlert automation	Verify automated shed/soak during FlexAlerts
Connectivity gaps (no/unreliable broadband)	Quantify the share of willing-to-participate homes lacking reliable Wi-Fi. If thresholds are exceeded, evaluate low-cost over-the-air backups.
Vendor lock-in	Show that thermostats and HPWHs can use the same MIDAS JSON schema, proving interoperability across brands; publish an open reference.
Uncertain customer economics	Calculate bill savings and simple payback by device class

5. Anticipated outcomes if this research concept is successful, either fully or partially.

If successful, the study will show that plug-and-play, MIDAS-responsive thermostats and HPWHs deliver verifiable load shifting, bill savings, and emissions reductions in low-income single-family homes maintaining the delivery of adequate hot water and space conditioning services and avoiding many of the program and technology costs that have stalled mass-market flexibility.

- **Safety.** Replaces in-home gas water heaters, cutting indoor NO_x; potential over-the-air fallback preserves signal continuity during outages and disasters.
- **Equity.** Removes enrollment hurdles common in low-income households: devices arrive pre-flashed to “listen” for MIDAS. Over-the-air contingency keeps households without reliable broadband included.
- **Affordability.** Expected annual bill savings of $50–$80 for thermostat-only with payback of incremental costs <1 year; $80–$150 bill savings for thermostat + HPWH, incremental cost payback ≤5 years (to be confirmed in the pilot).
- **Reliability.** Automated FlexAlert response delivers 400 watts sustained shed for ≥2 h per thermostat-only home and 800 watts per dual-device home. At one million homes, that’s 800 megawatts of fast, dispatchable capacity – material for CAISO contingency planning.
- **Sustainability.** Avoids ≥25 kg CO_2/yr per thermostat and ≥75 kg CO_2/yr per HPWH for over 100 kg CO_2/yr per dual-device home. At one million homes, that scales to about 0.1 Mt CO_2/yr of avoided emissions.

Note: Figures reflect the pilot’s success thresholds to avoid overstating benefits.

6. Quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

The following key performance indicators will determine whether MIDAS-responsive thermostats and HPWHs deliver measurable, repeatable benefits in low-income homes. Each metric includes a clear measurement method, defined baselines, and success thresholds for both treatment groups. In addition, the project can develop and validate new metrics, for example, to quantify energy shifting under continuously varying price and CO_2 signals, or to characterize the trade-off between bill savings/load shifting and customer comfort.

Metric / Indicator	**Measurement method**	**Success threshold** *(examples to be refined)*	
		Thermostat only	***Thermostat + HPWH***
Bill savings	Weather-normalized bill comparison of AutoFlex days vs. non-Flex with matched non-participant control	≥ \$50 /yr-home	≥ \$80 /yr-home
FlexAlert shed	Meter-based hourly regression analysis; report average hourly shed over FlexAlert hours	≥ 0.4 kW /home	≥ 0.8 kW /home
CO_2 avoided	Product of shifted energy and hourly marginal-emissions; AutoFlex vs. non-Flex days	≥ 25 kg /yr-home	≥ 75 kg /yr-home
Service adequacy	Participants survey logs and direct measurements	> 99.9% of time	> 99.9% of time
Uptime	Device heartbeat logs; uptime = data received in ≥ 54 of 60 mins (90 %)	≥ 95 % of devices	≥ 95 % of devices

7. References to information that supports the research concept's merits.

California Energy Commission. 2025. *Market Informed Demand Automation Server (MIDAS) Documentation: Interacting with the MIDAS API.* Available at https://gitlab.com/CEC-MIDAS/midas-documentation

Herter, Karen and Gavin Situ. 2021. *Analysis of Potential Amendments to the Load Management Standards: Load Management Rulemaking, Docket Number 19-OIR-01.* California Energy Commission. Publication Number: CEC-400-2021-003-SF. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=241067

OpenADR Alliance. 2024. *OpenADR 3.1.0 Definitions.* San Ramon, CA.

California Public Utilities Commission. 2025. San Francisco, CA.

- *TECH Clean California implementation handbook and*
- *Self-Generation Incentive Program (SGIP) handbook*
- *Home broadband adoption report*

Cala Systems. 2025. *Cala heat-pump water heater product site & specifications.* https://www.calasystems.com

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8. 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

    The proposed concept would support this goal as follows.

MIDAS enables edge-controlled DERs by distributing simple, standard signals (Price, Schedule, CO_2, FlexAlert) that on-board firmware interprets locally to optimize operations. Because MIDAS is stateless, devices don't enroll in vendor clouds or VTNs; they simply "listen" and execute embedded logic using a standard JSON profile. The result is a uniform, utility-agnostic control layer that eliminates custom integrations and speeds portfolio growth.

- **Bulk-system services**. Predictable shed/soak during FlexAlerts and peak days; renewable soak shifts load into 11 a.m. to 3 p.m., reducing curtailment and evening ramps.

- **Distribution benefits**. Operators can map feeder groups or ZIP clusters to specific MIDAS Schedules to relieve local constraints without per-device dispatch or telemetry.
- **Carbon-aware operation**. CO_2 feeds drive hourly emissions minimization across the DER fleet so that thermal storage follows clean-energy availability, not just price.
- **Measurement & verification**. Impacts are meter verified, and benefits are attributed via standard billing.
- **Cybersecurity & privacy**. System design avoids remote appliance control, central device rosters, and collection of personally identifiable information; firmware includes opt-out/override and failsafe rules.
- **Scalable & equitable**. One signal works across thermostats and HPWHs; if early sites show Wi-Fi gaps, over-the-air fallback option preserves access in broadband-poor areas.

Net result: a software-defined, standards-based thermal battery at scale – integrating millions of small loads into a dependable DER portfolio that improves reliability, lowers costs, and advances decarbonization without aggregator-centric complexity.

Other EPIC-aligned benefits include:

a. **Transportation Electrification** is indirectly supported through a common control stack that could extend to EV chargers in future phases.

c. **Building Decarbonization.** Swaps gas water heaters for high-efficiency electric HPWHs in homes and shifts electric load to solar-rich hours.

d. **Achieving 100 % Net-Zero Carbon & Coordinated Role of Gas.** Demonstrates controllable electric alternatives that reduce reliance on gas peakers and household gas combustion while supporting renewable consumption.

e. **Climate Adaptation.** Automates FlexAlert response, providing fast, reliable peak-shaving capability during extreme-heat emergencies, bolstering grid resilience.