

DOCKETED

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EPIC Research Concept - The Challenge of Technology Switching Under Duress

Additional submitted attachment is included below.



**ELECTRIC PROGRAM INVESTMENT CHARGE 2021-2025 (EPIC 4)
RESEARCH CONCEPT PROPOSAL FORM**

The CEC is currently soliciting research concept ideas and other stakeholder input for the EPIC 4 Investment Plan. For those who would like to submit an idea for consideration, we ask that you complete this form and submit it to the CEC by 5:00 p.m. on **July 2, 2021**.

To submit the form, please visit the e-commenting [link](https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01), <https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-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 for your input.

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

Andrew Campbell, acampbell@berkeley.edu, (415) 515-4655

2. Please provide the name of the contact person’s organization or affiliation:

Energy Institute at Haas, University of California, Berkeley

3. Please provide a brief description of the proposed concept you would like the CEC to consider as part of the EPIC 4 Investment Plan. What is the purpose of the concept, and what would it seek to do?

The Challenge of Technology Switching Under Duress. Widespread electrification is a key element of most decarbonization strategies. Recent books including Bill Gates’ *How to Avoid a Climate Disaster* and Saul Griffith’s *Rewiring America: A Handbook for Winning the Climate Fight* call for “electrifying everything”. This includes switching from natural gas appliances, such as furnaces, water heaters and boilers, to electric appliances in millions of homes and businesses. A recent blog post from Lucas Davis illustrates how electrification of homes is being accelerated by new home construction in states like Texas and Florida. Houses, apartments and entire neighborhoods in these states are being built without natural gas. However, the dynamic is different in California, where the rate of new home construction is much lower. Strategies are needed to motivate households, landlords and businesses to substitute electricity for natural gas in already existing buildings. Commonly, appliances are only replaced at the time of a catastrophic failure, also referred to as “burnout”. The Energy Commission’s *California Building Decarbonization Assessment* finds that encouraging conversion to

electricity at the time of the natural gas appliance's burnout is likely to be far less expensive than retiring functioning appliances. However, at the time of burnout, the household or business may be desperate to quickly restore service. For example, researching an unfamiliar technology, assess the capacity of a home to support an electric heat pump and making any necessary electrical service upgrades will take time. This could involve too much discomfort for residents or loss of revenue for a business to consider. Making a quick like-for-like replacement could be very attractive. This proposed research concept is to study how to address the challenge of encouraging electrification when the normal circumstances for technology switching could be a barrier to the switch. The concept would produce empirical evidence about the technology switching challenge and recommend approaches to overcome the challenge. This would include examining the role that planned early retirements can have in preparing homes and businesses for the transition.

4. 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 technologies? 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, what data and information gaps would the proposed concept help fill, what specific stakeholders will use the results, and for what purpose(s)?

Achievement of the state's greenhouse gas emissions goals will require widespread adoption of electric technologies in existing buildings, in place of the incumbent fossil fuel technologies. The EPIC program has supported technologies that could enable this technically, but research is urgently needed on consumer adoption. Without strategies to cause fuel substitution at the time of appliance burnout, if not earlier, the market for electrification technologies will not grow at the pace that models show is needed. The time and cost to prepare a building for fuel substitution will be particular barrier. Natural gas-to-natural gas replacements is a standard practice that increases committed emissions for the life of the new appliance and needs to be slowed down. From a performance target standpoint, the percentage of appliance burnouts that lead to fuel switching needs to increase, to the 15% assumed by the Energy Commission in the building assessment's "minimal electrification" scenario, then beyond to the 50% and 90% assumed in the more aggressive scenarios. The users of this study will include energy efficiency and planning staff at the Energy Commission, regulators at the California Public Utilities Commission, and heat pump manufacturers and installers.

5. 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 costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the technology at scale?

A successful project will characterize the appliance fuel switching challenge today and recommend market and policy strategies that will increase the rate of fuel substitution at the time of appliance burnout and before. This could include recommended incentive structures that take in to account the remaining life of appliances and cause early retirement and fuel substitution.

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

The impact of the proposed research can be evaluated by estimating the increased cost effectiveness of electrification policies once the challenge of replacement upon burnout is quantified. The greenhouse gas reductions from accelerated electrification can also be estimated, including the reduction in committed emissions.

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

Davis, Lucas. "The Texas Power Crisis, New Home Construction, and Electric Heating" Energy Institute Blog, UC Berkeley, February 22, 2021, <https://energyathaas.wordpress.com/2021/02/22/the-texas-power-crisis-new-home-construction-and-electric-heating/>

Gates, Bill. *How to Avoid a Climate Disaster*, 2021.

Griffith, Saul. *Rewiring America: A Handbook for Winning the Climate Fight*, 2020.

Kenney, Michael, Nicholas Janusch, Ingrid Neumann, and Mike Jaske. 2021. *Draft California Building Decarbonization Assessment*. California Energy Commission. Publication Number: CEC-400-2021-006-SD.