

Behavior-Based Energy Efficiency : A Case Study of the Oakland EcoBlock

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Overview of EcoBlock

- The Oakland EcoBlock is a whole-systems urban sustainability project that aims to prototype a pathway to affordable urban decarbonization by means of block-scale retrofitting
- The primary research questions are:
 - What technology attributes are most strongly associated with energy efficient and/or flexible equipment purchasing decisions in the EcoBlock resident sample?
 - What are typical patterns of energy-related equipment operation in the EcoBlock resident sample, and which variables (e.g., demographic, environmental, other) are most strongly associated with these typical operational patterns?
 - How might the EcoBlock resident sample respond to disruptions to typical operating patterns (e.g., during a demand response event or similar), and which variables are most strongly associated with these responses?



Fruitvale EcoBlock



https://ecoblock.berkeley.edu/

Insights from literature review

Knowledge gaps

- Decision making context that impact the home energy upgrades among low-income households are particularly lacking
- Residential occupants tend to have high degree of influence over operational schedules and settings; These patterns vary among populations and are especially prominent during the pandemic

Key variables influencing home energy upgrade decisions and operations

Category	Personal	Contextual (long-term)	Contextual (short-term)	Operational patterns
Factors influencing technological choices	Socio-demographics	Ownership structure		
	Habits & lifestyle	Social network & ties to community		
	Knowledge & information access	Building characteristics		
	Attitudes & perceptions	Economic and policy environment		
	Financial resources & transaction costs	Culture & social norms		
Factors influencing technological operations	Socio-demographics	Physical surroundings (e.g. installed equipment and construction)	Time of day/week	Under normal conditions
	Degree of familiarity with building retrofit technologies	Social influences (e.g. friends and neighbors)	Physical conditions	Under atypical conditions (e.g. demand response event)
	Pro-environmental attitudes		Economic signals (e.g. price and incentives)	

Overview of choice survey

- **Goal**: To understand household energy upgrade decisions. The survey asks about what residents do or purchase to improve the function and comfort of their homes.
- Survey length: 15-20 mins
- Distributions
 - Online and in person in the summer of 2021 (Sep/Oct in the bay area)
- Survey content
 - General Information
 - Ownership; Gender; Education; Income; Household size, etc
 - Participant and Building information
 - Building types; Vintage; Sizes; Energy bill; Who pays the bill; Energy types, etc
 - General Purchasing Information, Motivations and Barriers
 - Who makes purchase decision; Reasons, barriers, and budget available for home energy upgrade decisions
 - <u>Knowledge and Information Channels</u>
 - Familiarity with home energy upgrade measures; Where did they learn about the measures, including public & utility programs, and social networks.
 - <u>Perceptions of Energy Efficient Improvements</u>
 - How do they view different home energy upgrade measures; How likely they would purchase/install the measures; How much do they think it will cost; The extent of impacts do they perceive (i.e., improved comfort, reduced costs, increased home value, and feedback from friends and family)? How do they view the burden of installation and operation?

Overview of operational behavior survey

- **Goal**: To understand household energy use patterns. The survey asks questions about energy-related equipment and appliances and how they are being used over the past few weeks.
- Survey length : 15-20 mins
- Distributions: Online over two seasons.
 - Online and in person in the Summer of 2021 and Winter of 2022
- Survey content:
 - Participants and building information
 - Ownership; gender; health; HVAC type; windows and shading type, etc
 - Upgrades and maintenance
 - Purchase/replacement schedule
 - Occupancy
 - Weekdays and weekend schedule
 - <u>Satisfaction levels</u>
 - Temperature; humidity; lighting; IAQ; noise; general quality
 - Energy-related actions
 - Thermostat; lights; fans; window A/C; windows; blinds; air purifier; dehumidifier; notify landlord

Survey distribution

Fruitvale EcoBlock



Green: Yes; Yellow: Interested; Clear: No or not now

- Choice survey released on July 27 2021
 - Virtual recruitments via email list & newsletter
 - In-personal community outreach
 - Target for 35 responses (one response per household required); Received 13 responses by Sep 20

Upcoming surveys

- Operational survey: Summer 2021 (Sep/Oct in the bay area)
- Operational survey: Winter 2022
- Target for 48 responses for each survey

Survey Incentives

• \$25 Visa gift card (virtual)

Challenges for recruitments

- Low responses via virtual recruitment alone
- Collecting digital consent forms are particularly challenging among this population, which requires access to printers or professional Adobe Acrobat Reader

Thank you for your attention!

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