

# Exploring New Dimensions of Energy Feedback

A Tangible, Community-Level Energy Display for a ZNE Building

**Kelsea Dombrowski**

MS, Community Development, UC Davis

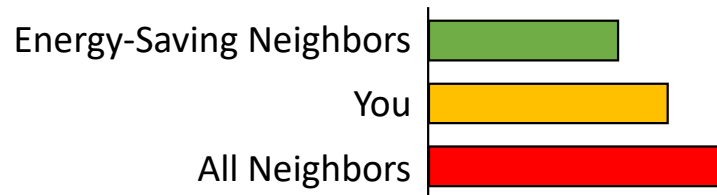
PhD Student, University of Michigan School of Natural Resources and Environment

BECC 2016    October 20-22, 2016    Baltimore, MD



# Background

	Consumer	Energy	Interface
<b>Traditional Energy Feedback</b>	Household	Electricity from grid	Scientific (numbers and graphs)



# Background

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Traditional Energy Feedback</b>	Household	Electricity from grid	Numbers and graphs
<b>New Dimensions</b>	Commercial, community-level	Other resources, renewable energy	Artistic (ambient, tangible, aesthetic)

# Background

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Traditional Energy Feedback</b>	Household	Electricity from grid	Numbers and graphs
<b>New Dimensions</b>	Commercial, community-level	Other resources, renewable energy	Artistic (ambient, tangible, aesthetic)



Nuage Vert

# Present Research

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Traditional Energy Feedback</b>	Household	Electricity from grid	Numbers and graphs
<b>New Dimensions</b>	Commercial, community-level	Other resources, renewable energy	Artistic (ambient, tangible, aesthetic)
<b>Present Research</b>	Community-level, workplace	Zero-net energy building	Tangible, ambient, aesthetic

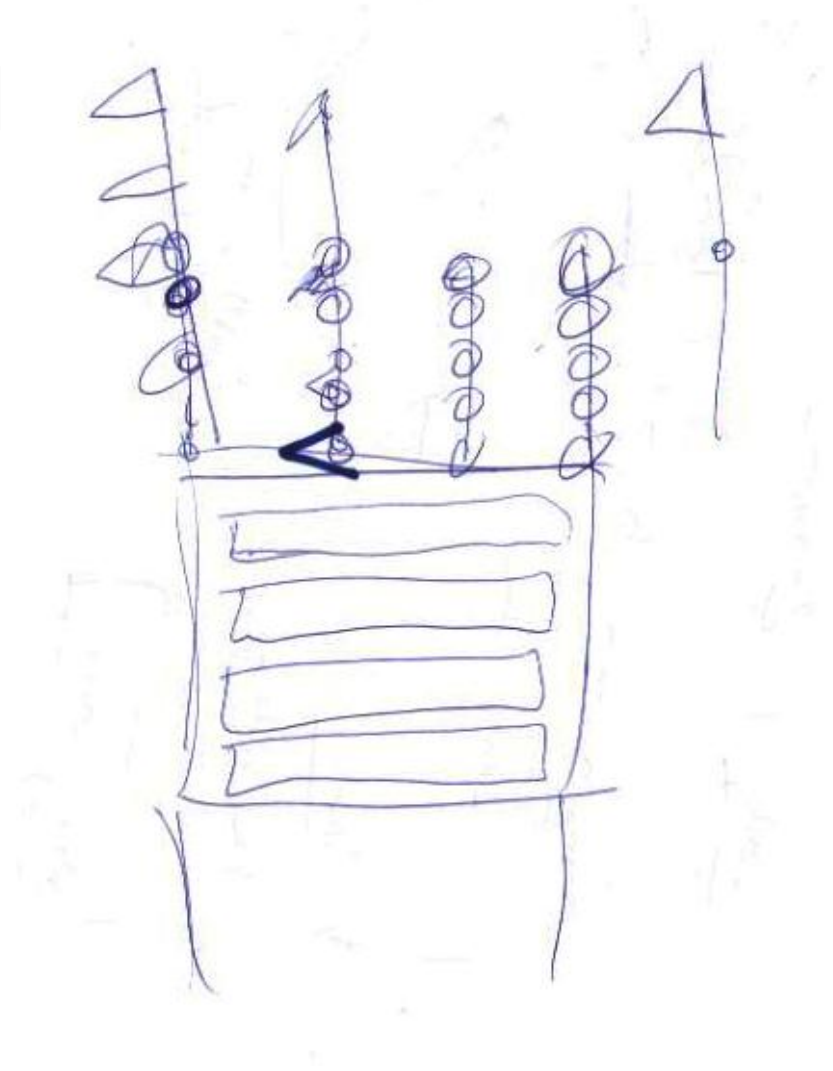
# Setting

- West Village in Davis, CA
  - Largest planned Zero Net Energy (ZNE) development in US
    - Yet to meet ZNE goals
- Energy & Transportation Research Cluster
  - Plug-In Hybrid & Electric Vehicle Research Center



# Method

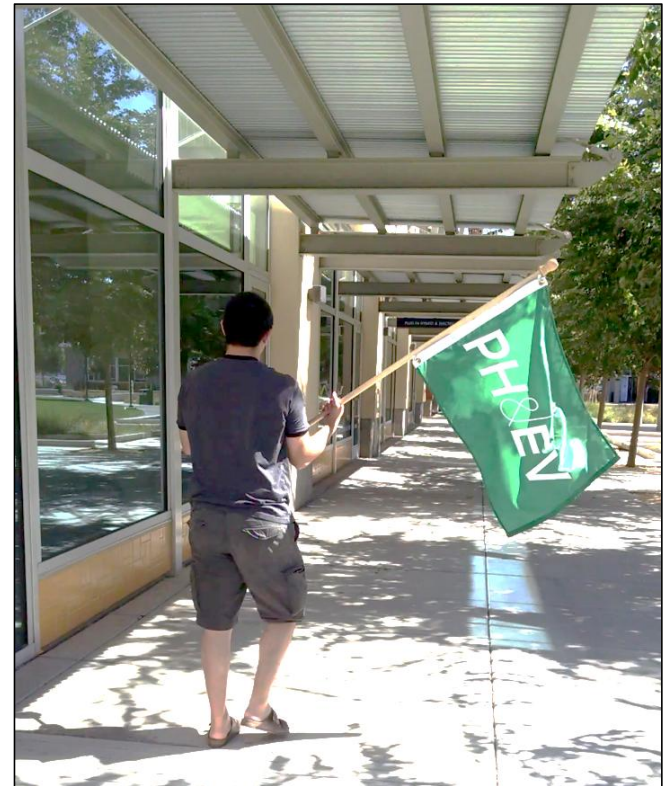
- **Feedback design**
  - Survey and focus group
- **Feedback evaluation**
  - Experiment and focus group



# Feedback Design

- **Flag Feedback**

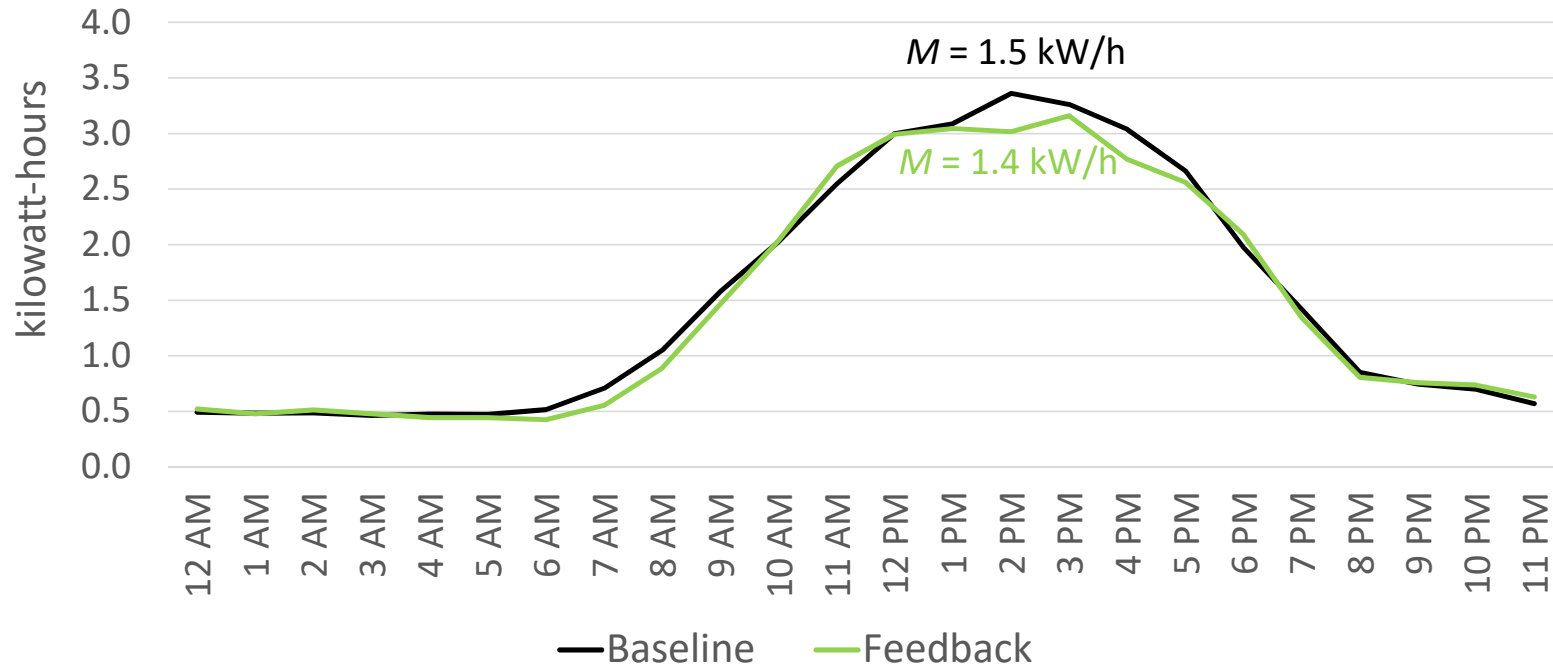
- Red or green flag
- ZNE goal
- Lights and plug loads
- HOBO loggers
- The Flag Ceremony
  - 15 seconds of Rocky v. Darth Vader
  - “Marching”
  - 9 am, 12 pm, 4 pm





# Feedback Evaluation

## Average Hourly Consumption on Weekdays



# Focus Group Theme: Identity

“It gave our office character...made us different...unique.”

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Present Research</b>	Community-level, workplace		
<b>Themes</b>	<b>Identity</b>		

# Focus Group Theme: Granularity

“OK, you’re waving a flag. Now say something.”

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Present Research</b>	Community-level, workplace		
<b>Themes</b>	Identity, <b>Granularity</b>		

# Focus Group Theme: Feedback Standard

“Need to expand to other offices... have a competition”

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Present Research</b>	Community-level, workplace	Zero-net energy building	
<b>Themes</b>	Identity, Granularity	<b>Feedback standard</b>	

# Focus Group Theme: Salience

“The thing about the flags... They’re just there.”

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Present Research</b>	Community-level, workplace	Zero-net energy building	Tangible, ambient, aesthetic
<b>Themes</b>	Identity, Granularity	Feedback standard	<b>Salience</b>

# Focus Group Theme: Routine

“Instead of thinking it’s lunchtime, I think, ‘It’s flag time!’”

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Present Research</b>	Community-level, workplace	Zero-net energy building	Tangible, ambient, aesthetic
<b>Themes</b>	Identity, Granularity	Feedback standard	Saliency, <b>Routine</b>

# Focus Group Theme: Emotional Connection

“[The music] added an emotional element”

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Present Research</b>	Community-level, workplace	Zero-net energy building	Tangible, ambient, aesthetic
<b>Themes</b>	Identity, Granularity	Feedback standard	Saliency, Routine, <b>Emotional connection</b>

# Conclusion

New dimensions of energy feedback may complement more traditional types feedback.

	<b>Consumer</b>	<b>Energy</b>	<b>Interface</b>
<b>Present Research</b>	Community-level, workplace	Zero-net energy building	Tangible, ambient, aesthetic
<b>Themes</b>	Identity, Granularity	Feedback standard	Salience, Routine, Emotional connection



# Thank You

- [kdombrov@umich.edu](mailto:kdombrov@umich.edu)
- [cEnergi.ucdavis.edu](http://cEnergi.ucdavis.edu)

