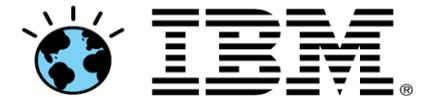


REDUCING RESOURCE CONSUMPTION IN STUDENT HOUSING THROUGH FEEDBACK & MOTIVATION



Amanda K. Sherman

Lisa Legault, PhD

Stephen Bird, PhD

Susan Powers, PhD

Alan Schay



Why do people waste energy and resources?

- People waste A LOT of energy
 - Individual human actions exert significant effects on climate change, environmental destruction, and resource depletion
 - Waste occurs despite incentive programs & regulations
- We know we need to behave in more pro-environmental ways. Yet...we don't.



WHY?

Why do people waste energy and resources?

We suggest 2 main reasons:

- People either *lack motivation*, or have the “wrong kind” of motivation
 - Lack of connection to the goal of conservation
 - External incentives (or split-incentive) issues
- People *don't know how to conserve*



Main objectives of this research

- To develop and test interventions that target **personal** motivation to conserve electricity and water
- To test the effectiveness of continuous and timely energy and resource **feedback**

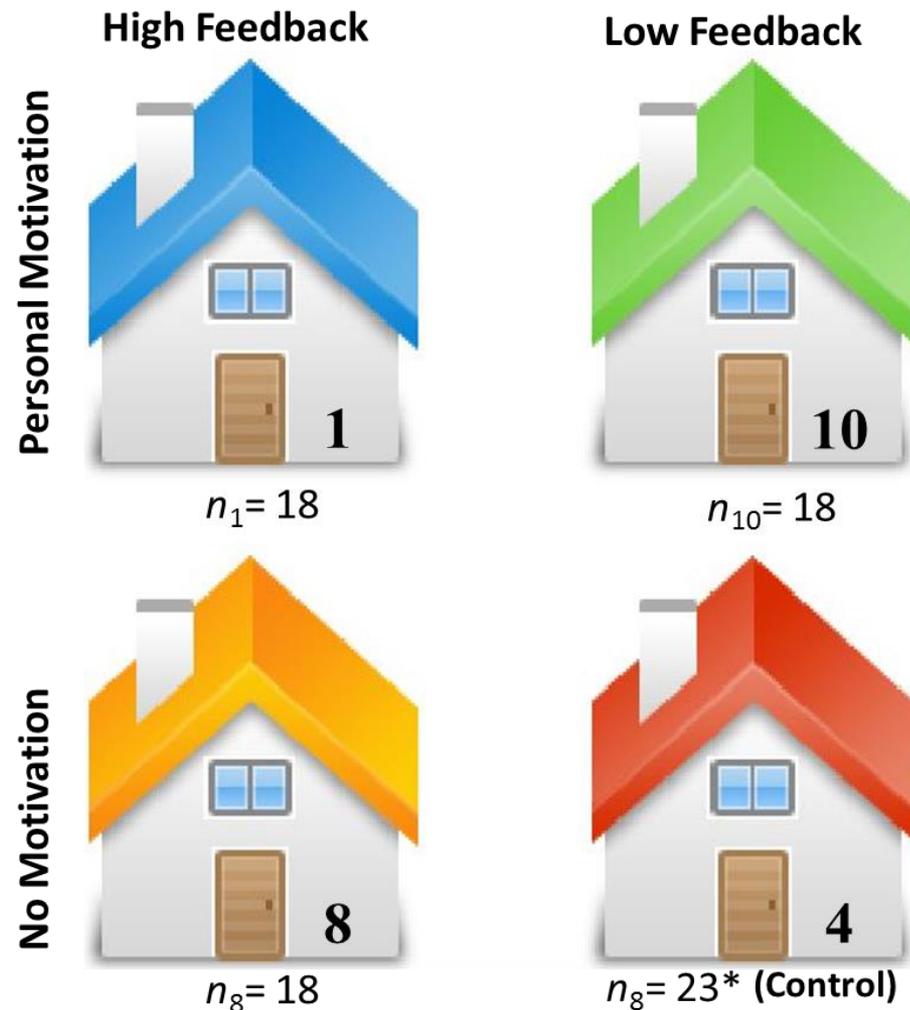


Hypotheses

- ✓ Main effect of motivation
- ✓ Main effect of feedback
- ✓ Cumulative effect of motivation + feedback
- ✓ Effects explained by changes in attitudes and motivation



Overview of experimental design



Targeting personal motivation: The intervention

- Reflected on and wrote about **their own reasons** for wanting to conserve energy and water
 - Health concerns
 - Environmental destruction
 - Climate change
 - Financial cost
 - Preserving the earth for future generations
 - Energy security
- Set group electricity and water goals
- Pledged commitment to their goals
- Motivational “nudges” throughout spring semester

Clarkson
UNIVERSITY

SMARTHOUSINGPROJECT

Smart Housing Workshop # 1 – January 13th and 14th, 2015

Name [REDACTED] Building# 1 Apartment # 1021

Exercise #1: Individual Reflection

After hearing about the various reasons to conserve energy and water (environmental, health, security, climate, social, and community reasons), which of these reflect *your* personal reasons for reducing energy and water consumption? That is, what energy problems are most important to you personally and are problems that you would like to try to help address in your own life?

I would like to conserve energy because I think that it is important to stop global warming as much as possible. Global warming is shrinking the ice caps and reducing snow cover around the world. I also want to reduce the amount of money spent by our country and around the globe on efforts required to provide health care to airborne issues.

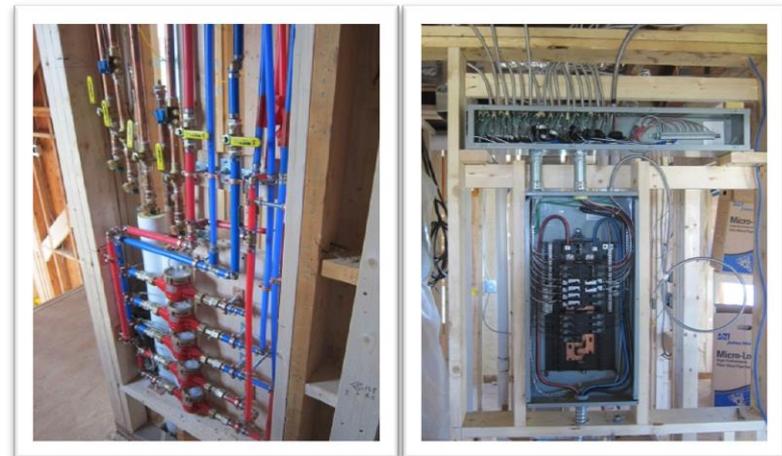
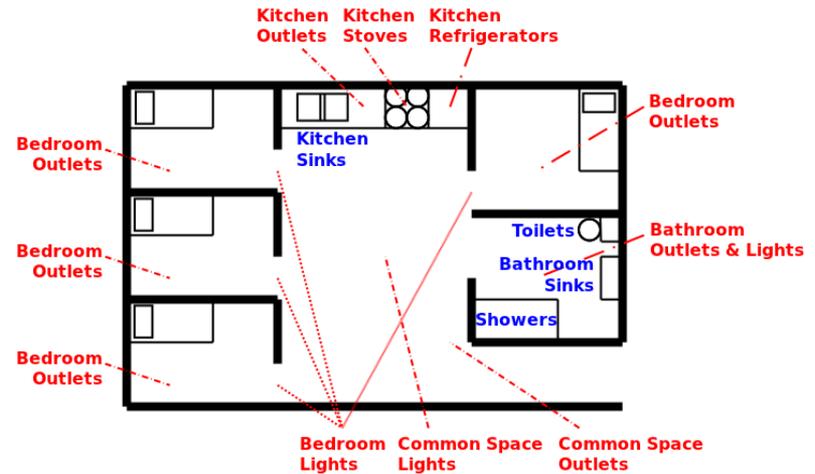
Providing energy feedback

- First, students' electricity and water consumption was measured (at baseline)

Type	Breakdown
Electricity	Lights
	Outlets
	Stove/Oven
	Refrigerator
	Other/Misc.

Water	Hot
	Cold
	Overall

- Between the 4 buildings, over 3,600 variables are collected every minute!



Feedback interface

Electricity

Water

Temperature

Living Room Outlets

Common Lights

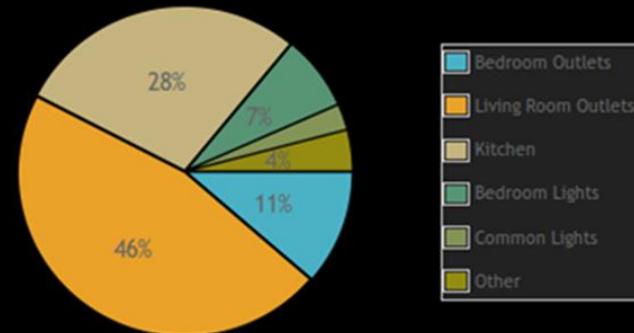
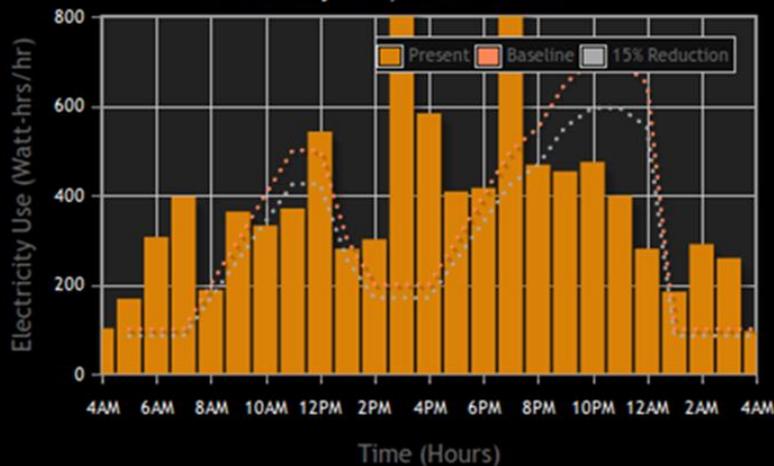
Bedroom Lights

Bedroom Outlets

Shower

Kitchen Sink

Electricity Use, Last 24 Hours



Date Range:

2 Weeks

1 Day

1 Hour

At the current rate: You will use **15% less electricity** this hour than was typical for the same hour of day during the baseline period.

Tip of the day: Reducing the amount of time spent in the shower by just 2 minutes can save 5 gallons of water!

Temp: --.-- °F

Humidity: --.- %

Goals

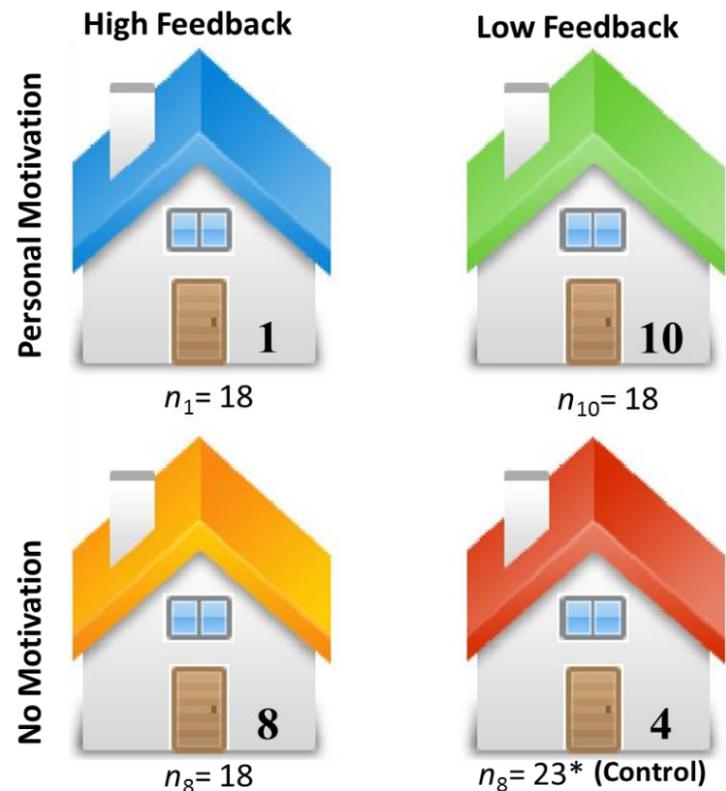
Report Issue

Help

Design and testing: Utility use

For electricity and water:

- High Feedback vs. Low Feedback
 - Personal Motivation vs. No Motivation
 - Combined Motivation + Feedback vs. Neither
- We compared effects across 77 Woodstock apartments
 - Electricity and water use recorded over a 3 month period



Design and testing: Survey responses

We also measured various psychological variables across all participants (N=353 individuals in 77 apartments)

- Type of motivation toward the environment (internal, external, or amotivated)
- Environmental emotions (distress, empathy, disgust)
- Environmental competence/knowledge
- Self-reported frequency of proenvironmental behaviors (e.g., recycling)
- Enjoyment of proenvironmental behaviors

Results

What did we find?



Preliminary findings:

Descriptive statistics and correlations among utility variables

	Electricity (Wh/day/person)	Overall Water (G/day/person)	Hot Water (G/day/person)
Mean	2240.27	31.14	15.30
Standard Deviation	752.55	11.00	5.90
Skewness	.97	1.36	.93
Kurtosis	.73	1.05	1.052
Correlations			
Overall Water	.21		
Hot Water	.27*	.89***	

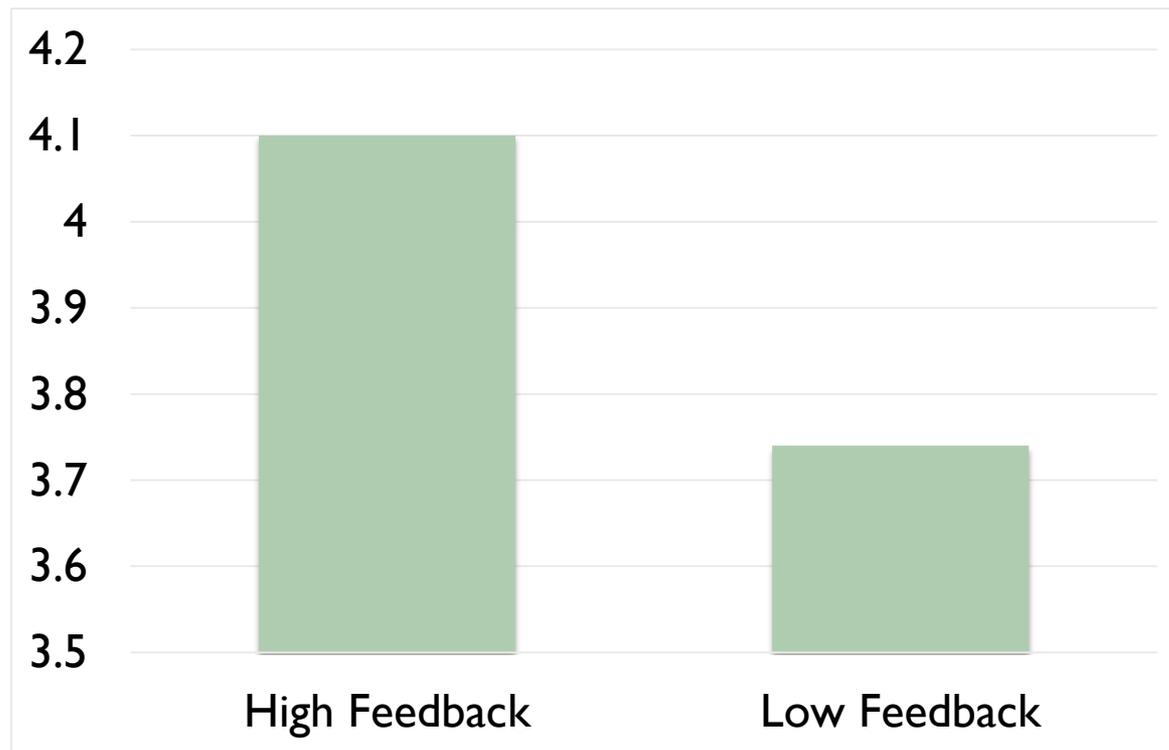
*p<.05; ***p<.0001

Preliminary findings: Correlations among survey variables

	External	Amotiv.	Empathy	Disgust	Distress	Knowledge	Behavior	Enjoyment
Personal Motivation	-.02	-.53***	.60***	.59***	.38***	.25***	.54***	.64***
External Motivation		.34***	-.10	-.01	-.07	-.10 [†]	.00	.14*
Amotivation			-.56***	-.43***	-.12 [†]	-.26***	-.37***	-.30***
Empathy				.78***	.58***	.26***	.49***	.58***
Disgust					.67***	.22**	.42***	.55***
Distress						.05	.29***	.41***
Knowledge							.20**	.12*
Behavior								.43***

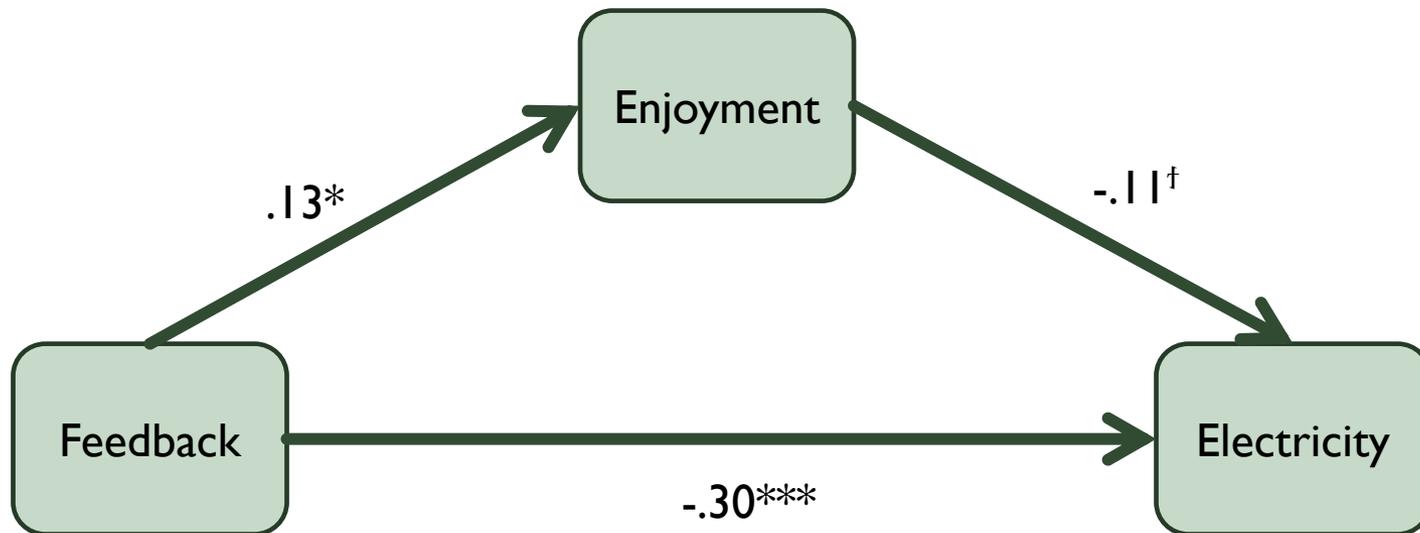
[†]p<.10; *p<.05; **p<.01; ***p<.0001

Differences in enjoyment of PEB as a function of feedback



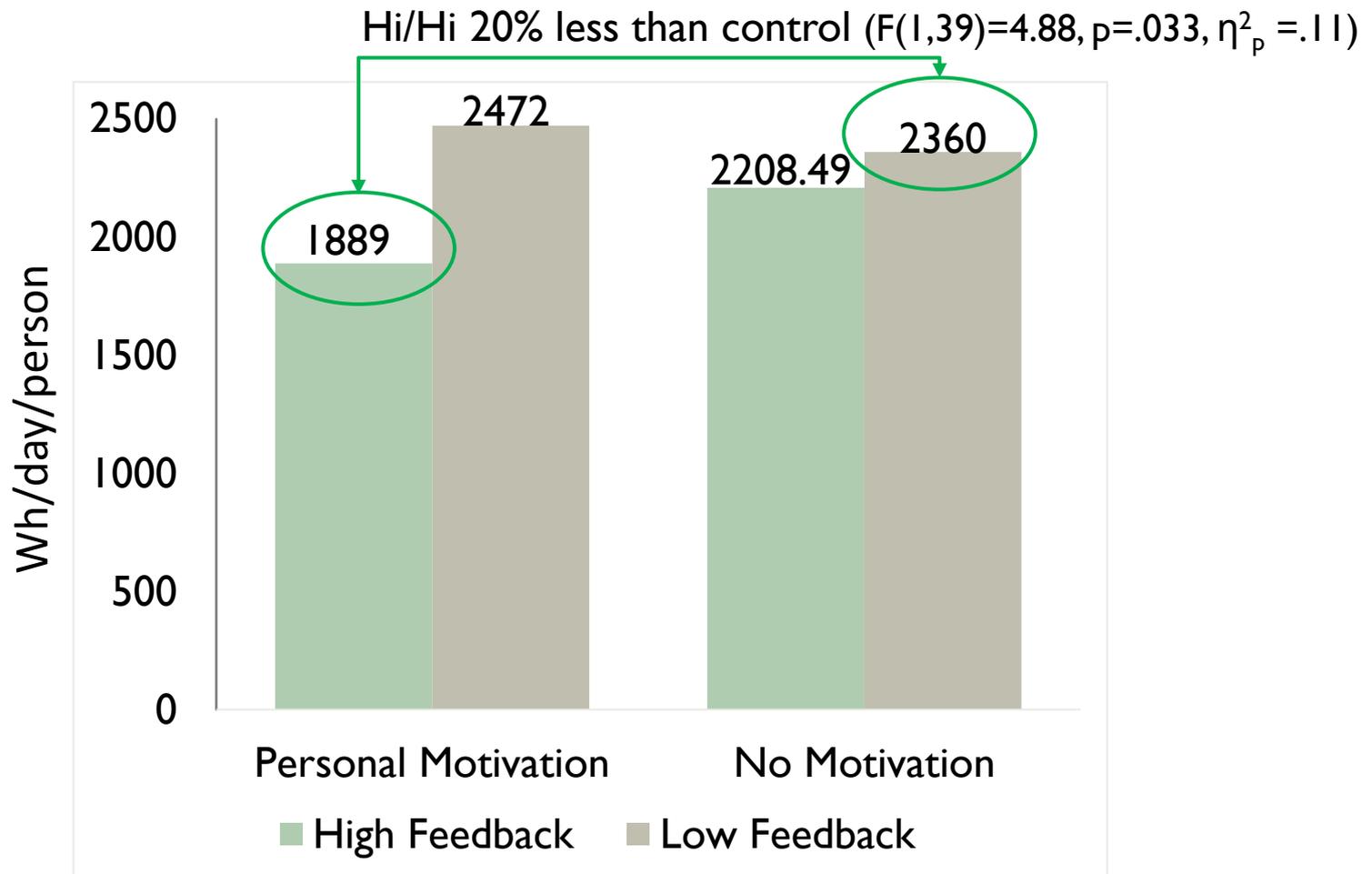
$F(1, 258)=4.900, p=.028, \eta^2p=.020$

Mediating effect of enjoyment

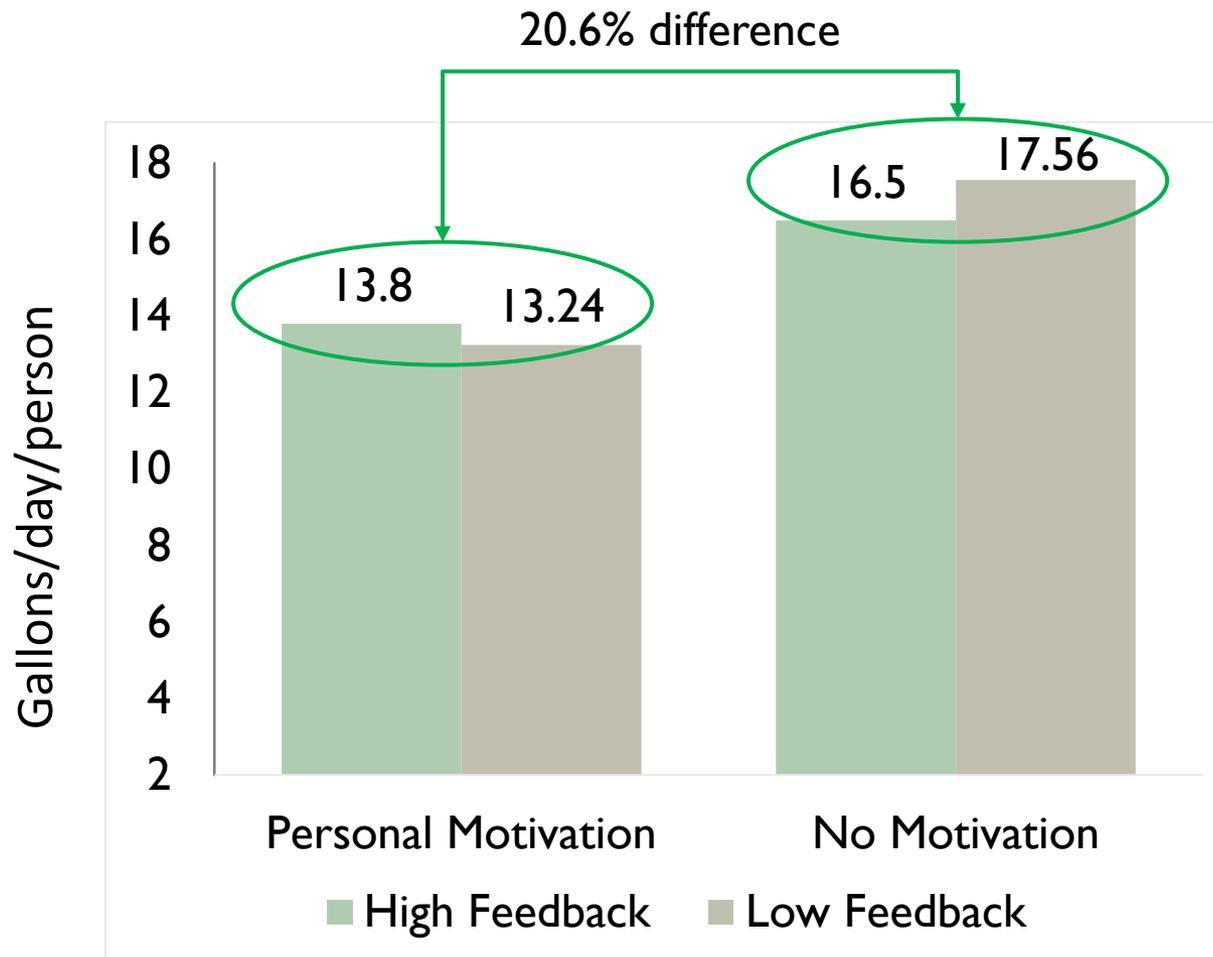


$^\dagger p < .10$; $* p < .05$; $*** p < .0001$

Effects of motivation and feedback on daily electricity consumption



Effects of motivation and feedback on daily hot water use



Conclusions

- **Several hypotheses supported**
 - Effect of feedback on electricity
 - Combined effect of feedback + motivation on electricity **(-20%!!!)**
 - Effect of motivation on hot water **(-20.6%!!!)**
 - Campus-wide or nation-wide scale = substantial savings \$
 - But, no effect on overall water
- Mechanisms to reduce hot water may be different than mechanisms to reduce electricity
 - Feedback system was not effective in targeting major sources of hot water consumption, such as shower time. Rather, **motivational intervention appears to work better in this domain.**

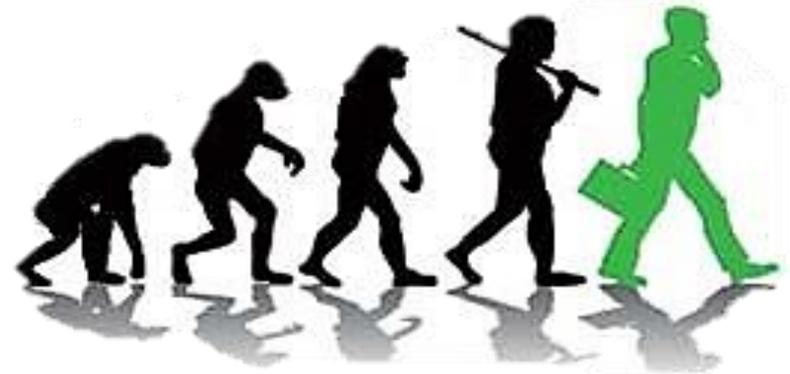
Regrding the feedback screens...

- Those who received the feedback intervention reported significantly greater **enjoyment of PEB** compared to those who did not receive feedback
 - This was the sole effect of interventions on motivation
- Feedback screens **caused** residents to enjoy saving energy and engaging in proenvironmental ways. Presumably, feedback made energy conservation **more fun and interesting**
- Thus may be more prudent to focus on developing the **intrinsically interesting and aesthetically enjoyable** aspects of feedback screens.

What's next?

- Given the importance of personal motivation in promoting PEB, how can we take this further?
 - highly personalized motivational messaging
- How can we better integrate personalized motivational messages with feedback displays?

“Why might YOU want to conserve energy and water?”



Thank you!

We would like to acknowledge those who have contributed their invaluable time and constructive feedback to improve the quality of our work.



NYSERDA

