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# Split Incentives in Low-Income Housing: Challenges and Solutions



Columbia University  
MAILMAN SCHOOL  
OF PUBLIC HEALTH



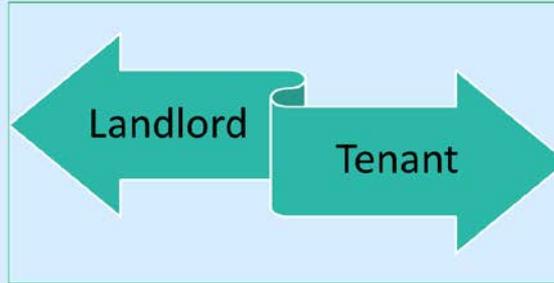
# Outline

1. Describing the problem
  - Split incentive types
  - Energy insecurity
  - Scope of economic impact
2. Tenant Bill-payers
  - Policy Responses
  - Landlords as linchpins
  - Proposal
3. Landlord Bill-payers
  - Low-income housing; University Housing, etc.
    - Smart Housing Project at Clarkson University
    - relevance to low-income housing
  - Differing approaches to low-income energy problems

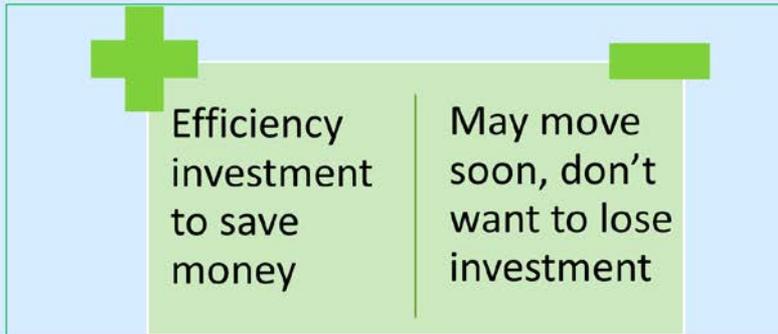
## 4 Kinds of Split Incentives

### Rental

1. Landlord Owner
2. Tenant Owner



### 3. Temporal



### 4. Utility



# Solving Janet's Problem

*Janet is a renter living under the poverty line. She is a beneficiary of housing support via HUD's Section 8 Program. Her monthly heating bill is very high because the windows are single-paned, there is limited insulation, and doors allow heat out.*

*There is no incentive for her landlord to upgrade her apartment because s/he is not responsible for paying the gas or electric bill for her unit. A large percentage of the resources and heating assistance that she receives are – literally – going out the window as much of her energy heats the outdoors. Meanwhile she is fully charged for all of this energy use.*

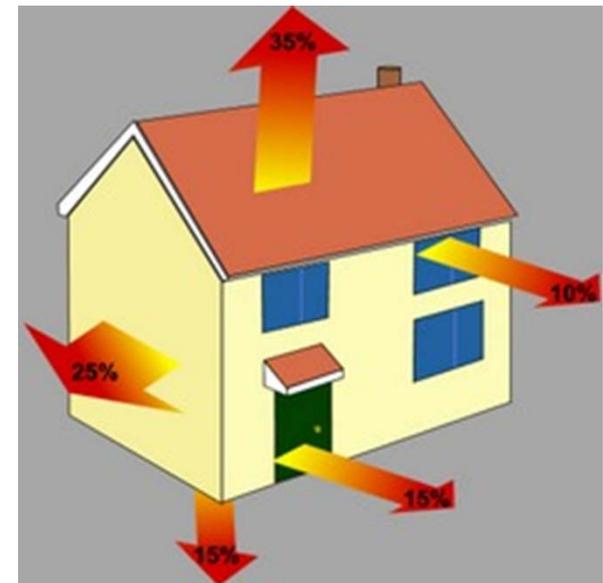
Hernández, Diana, and Stephen Bird. "Energy Burden and the Need for Integrated Low-Income Housing and Energy Policy." *Poverty & Public Policy* 2, no. 4 (2010).

Bird, Stephen & Diana Hernández. "Policy Options for the Split Incentive: Increasing Energy Efficiency for Low-Income Renters." *Energy Policy* 48, Sept., 506-514 (2012).

# Problem in a nutshell

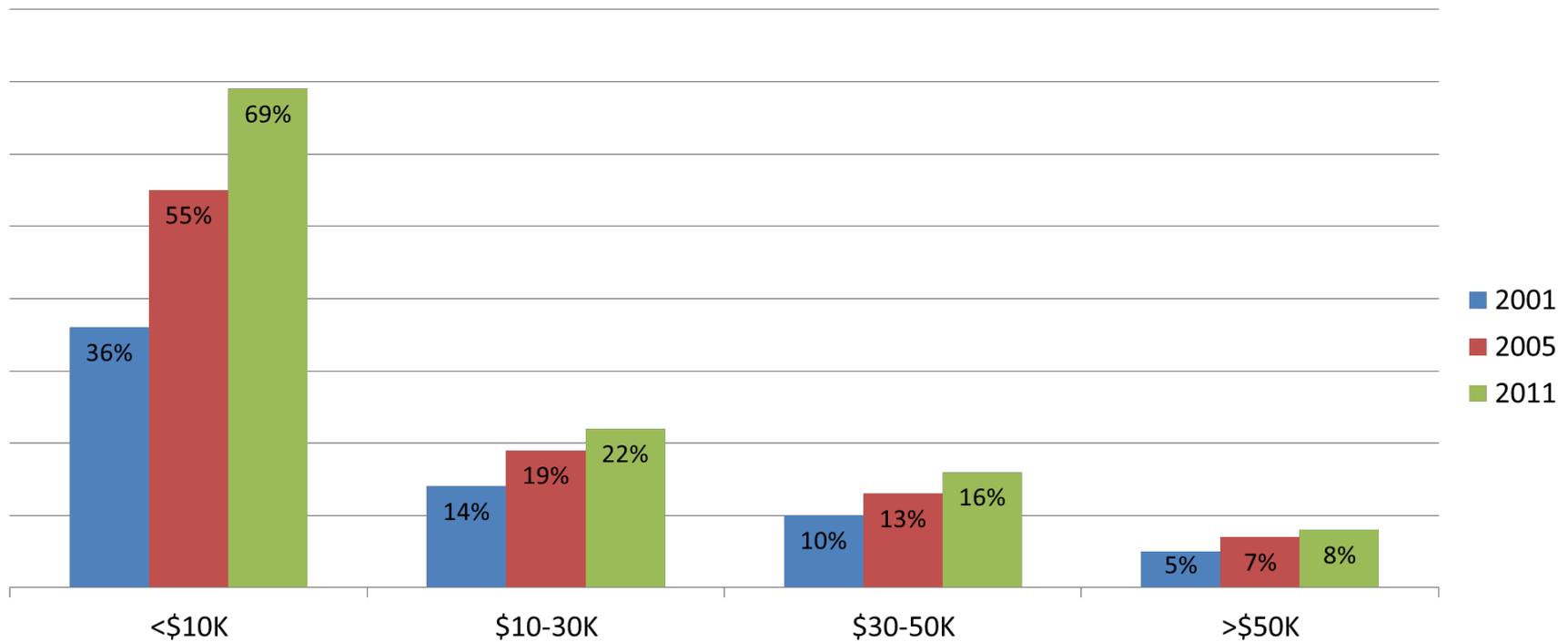
- Low-income landlords have no incentive to create energy efficient units
  - Low-income tenants are most vulnerable to energy burden
- Affects 1.89% of all U.S. energy use
  - Potential for \$4-11 billion in yearly savings
- Indirect negative consequences:
  - health impacts, rapport / relationships, quality of life
- Barriers to potential solution:  
Scale, endurance, incentives, savings, & political disfavor

Similar problems in Canada, EU, and other advanced industrialized countries ...



# Energy Burden

Energy Costs as Percent of After-Tax Income, U.S. \*



\* Source: ACCCE, 2011

# Residential Tenant-Paid Percentage of Total U.S. Energy Consumption and Potential Savings (\* rough estimation)

## All tenant paid energy (U.S.)

Residential Energy	22%		(33% of efficiency potential)
Rental Units	28%	$22 * .28$	6.16 %
Direct Energy Costs	88%	$6.16 * .88$	5.42%
U.S. Energy Expenditure ('09)	\$1.06 trillion/yr	$5.42 \% *$ 1.06 t	\$ 57 billion /yr
Range of Savings Possible	20-55%	* \$57 b	\$ 11 – 31 b / yr

## Low-Income tenant paid energy (U.S.)

Residential Energy	22%		(33% of efficiency potential)
Rental Units	28%	$22 * .28$	6.16 %
Energy Assistance Eligible	35%	$6.16 * .35$	2.16%
Direct Energy Costs	88%	$2.16 * .88$	1.89%
U.S. Energy Expenditure ('09)	\$1.06 trillion/yr	$1.89 \% *$ 1.06 t	\$20 billion /yr
Range of Savings Possible	20-55%	* \$20b	\$4 – 11 b / yr

# Policy Responses for Split Incentives

	Description	Concerns
<b><u>Contracts</u></b>		
Green or energy efficiency lease	<ul style="list-style-type: none"><li>Landlord/tenant agreement to conserve energy; retrofit investments are trickled down to tenant</li></ul>	<ul style="list-style-type: none"><li>Landlord and tenant must cooperate</li><li>Ongoing maintenance necessary</li><li>Geared toward commercial leases</li></ul>
Energy efficiency mortgages (PACE)	<ul style="list-style-type: none"><li>Externally funded loan attached to the property</li></ul>	<ul style="list-style-type: none"><li>Benefits remain with the property and lien complicates property resale</li></ul>
On-bill financing	<ul style="list-style-type: none"><li>Capital improvements are tied directly to utility company payments</li></ul>	<ul style="list-style-type: none"><li>Usually focused on live-in homeowners, not tenants</li></ul>

# Policy Responses for Split Incentives

	Description	Concerns
<b><u>Regulation</u></b>		
Green building codes	<ul style="list-style-type: none"><li>Higher energy standards for new construction</li></ul>	<ul style="list-style-type: none"><li>Only apply to new construction</li><li>High cost creates bias against low-income tenants</li></ul>
Low-income rental mandate	<ul style="list-style-type: none"><li>Mandate of higher energy standards for low-income housing</li></ul>	<ul style="list-style-type: none"><li>Creates strong disincentive to provide low-income housing</li></ul>
<b><u>All-in Services</u></b>		
Weatherization Assistance Program	<ul style="list-style-type: none"><li>National weatherization program, usually implemented as grants</li><li>Differs from state to state</li></ul>	<ul style="list-style-type: none"><li>Cannot be implemented at scale (cost);</li><li>Inefficient; little maintenance</li><li>Barely used for low-income rentals</li></ul>
Concierge services	<ul style="list-style-type: none"><li>Small comprehensive programs combine efficiency with education</li></ul>	<ul style="list-style-type: none"><li>Cannot be implemented at scale because of cost: highest expense</li></ul>

# New York's On-Bill-Recovery-Financing-Program

- January 2012
  - serves 1-4 unit residential homes, plus non-profits
  - renters can participate but...
    - need: high credit scores, low debt, no past negative collections, liens etc.
  - Low-income renters unlikely to participate because of stringent requirements, and short term rental periods..

# Policy Proposal:

## On-bill Financing w/ Landlord Incentives

“Landlord as linchpin”

1. On-bill financing
  1. Landlord initiates program
  2. Tenant pays through utility bill
  3. utility bill stays with unit (solves temporal problem – tenant changeover)
2. Weatherization / “system benefits charge” money:
  1. used to lower interest rates and provide default/risk protection to landlord and utility
  2. actual efficiency upgrade money provided by bank loan

# Policy Proposal:

## On-bill Financing w/ Landlord Incentives

3. Landlord gets small incentive (controversial)
  1. conditions:
    1. inspections;
    2. transparency;
    3. commitment: low-income rental unit
4. Tenant gains savings
  1. Incentives for tenant to maintain energy savings remain (e.g. market based)
  2. Savings increase over time; esp. after loan payoff
  3. Unit remains committed to low-income tenancy
5. Utility
  1. protected from risk/default
  2. Decoupling (or similar) critical for utility buy-in

# Two Examples of an On-Bill Financing Scheme for Low-Income Rental Unit(s)

<b>Loan amount:</b>	\$6000	\$3800
<b>Financing:</b>	3% @ 15 years (interest rate subsidized)	0% @ 7 years (interest rate subsidized)
<b>Financing cost per month:</b>	\$43	\$45
<b>Landlord incentive (month):</b>	\$10 (first 5 years)	\$5 (first 4 years)
<b>Projected savings (month):</b>	\$67 in electricity & heating	\$54 in electricity & heating
<b>Monthly savings for tenant:</b>	\$14 (first 5 years) \$24 (years 6-15) \$67 (years 16 and on...)	\$4 (first 5 years) \$9 (years 6-7) \$54 (years 8 and on...)
<b>Total Landlord incentive:</b>	5 x \$120/yr payments total: \$600	4 x \$60/yr payments total: \$240

# Why will it work?

- Voluntary
- Incentives for all stakeholders
  - *tenant* – savings
  - *landlord* – savings and investment
  - *utility* – protection and decoupling
- Savings exist; costs addressed *primarily* by Savings (not grants)
- Longevity (inspections)
- Transparency on all transactions



Politics?  
Scale?

# Landlord as billpayer: University Housing, Public Housing Projects in United States

- University Housing
  - 13 million students
- Public Housing Projects
  - 1.2 million households
  - ~2.9 million residents

**Heat, Electricity, and Water Bills are paid by Agency or University**

**Residents have little or no incentive to conserve or behave efficiently**

**“Landlord” ownership form of split incentive**

# Landlord as billpayer

## The Smart Housing Project at Clarkson University

### Background

- 3 year project (3 “cohorts”): n=224
- Funding by NYSERDA, IBM, Clarkson:  
~\$350 k
- Combined effects of
  - energy information / education
  - real-time feedback on resource use (email, internet “dashboard,” and apartment screen)
  - motivation and goal-setting (individual & group)



# Yr 1: '13-14; Yr 2: '14-15 Yr 3: '15-16

Repeat

- Summer 2013:  
Construction to finished apartments
- Fall Semester:  
Record *baseline* energy & water use
- Spring Semester: Workshops  
(Informational, Feedback Training)
- February: Introduce direct feedback
  - Smart Screen & Online Dashboard
  - Shower Orb
  - Email Messaging

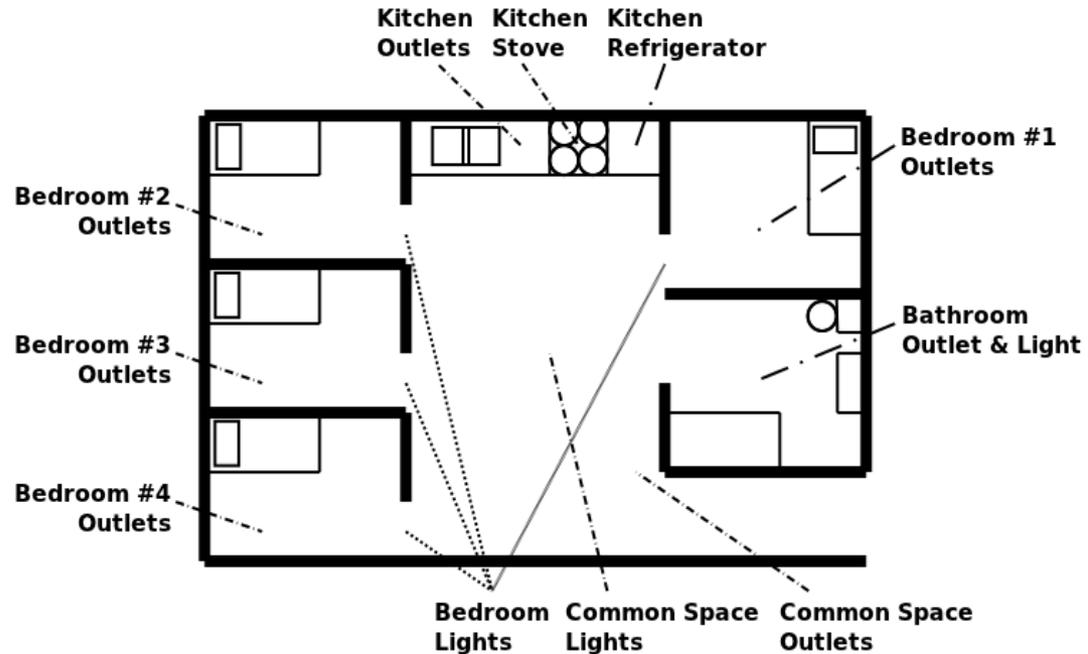


# Research Objectives

- Quantify and understand student use of utilities
- Identify ways to motivate students to modify behavior
  - Motivation, Goals, Feedback
- Improve priorities for renovation and design
  - Thermal control
  - Appliances

# Data Collection is Extensive

Type	Breakdown
Electricity	Lights Outlets Stove/Oven Refrigerator Other/Misc.
Env. Quality	CO/CO <sub>2</sub> Particulate Matter Temperature Relative Humidity
Water	Hot Cold Overall



# Feedback Display & Online Dashboard

Electricity

Water

Temperature

Living Room Outlets

Common Lights

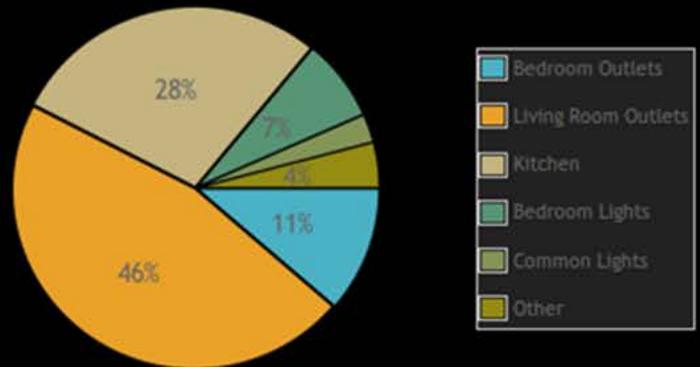
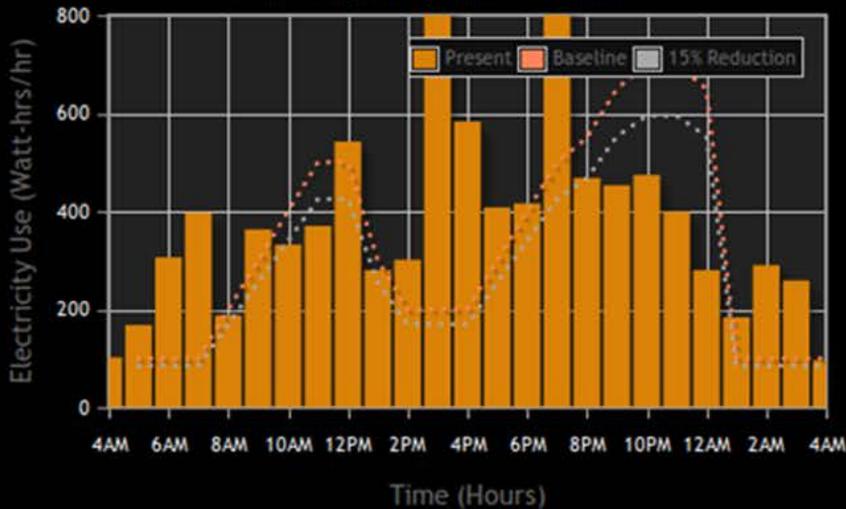
Bedroom Lights

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

# Cost analysis shows water savings critical (counter-intuitive)

- 4 Buildings, 130 students, 200 days/year
- Utility cost – average AY14 for campus
- Assume 10% reduction →
  - Potential \$1,600 annual savings

Utility	Resource Use	Utility cost	Current Cost
Electricity	59.8 MWh	\$77/MWh	\$4,600
<b>Water</b>	<b>728 kgal</b>	<b>\$12.65/ kgal</b>	<b>\$9,000</b>
NG (hot water)	3200 therms	\$0.768/therm	\$2,500
TOTAL			\$16,100

# *Hypothesis for change:* Combined Feedback & Motivational Program

Activate / Internalize *their* motivations → Education and goal-setting  
Make resource use visible → Granular, real-time feedback

## Motivations

- Environmental Impacts
- Public / Personal Health
- Climate Change
- Energy Security
- Resource Depletion
- Cost

## Action-Oriented Goals

- Take shorter showers
- Turn off lights
- Use less water when dish-washing

# Program Design

**High Feedback**



**Low Feedback**



**High Motivation**



**Low Motivation**



(Control)

# Motivational Interventions

## Motivating Energy Efficiency

### Energy literacy & Motivational construct

#### Workshops

- Information on *how* to conserve
- Elicit internal motivation; *why* you wish to conserve
- Feedback training

### Goal-setting

#### Behaviors to adopt (actions, non-numeric)

- e.g., filling the sink to wash the dishes, rather than leaving the water running.

### Messaging & Real-time feedback

#### Emails (2/wk) & Reports

- Energy use compared to baseline
- Motivational “triggers”

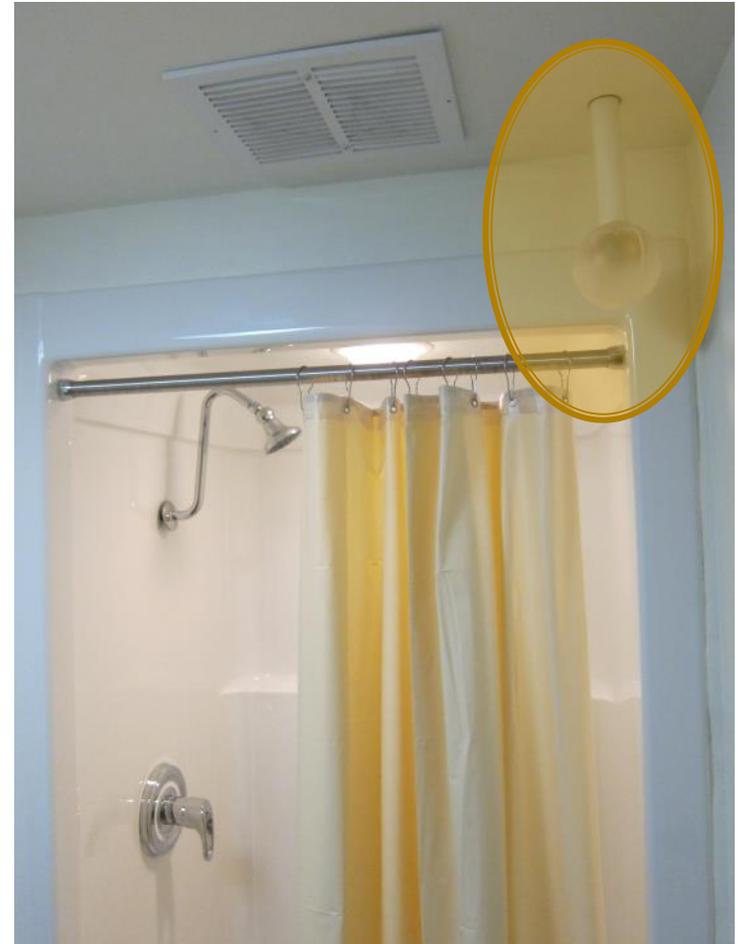
#### Feedback Display

- Energy use compared to baseline, last week, etc.
- Tips (action reminders)

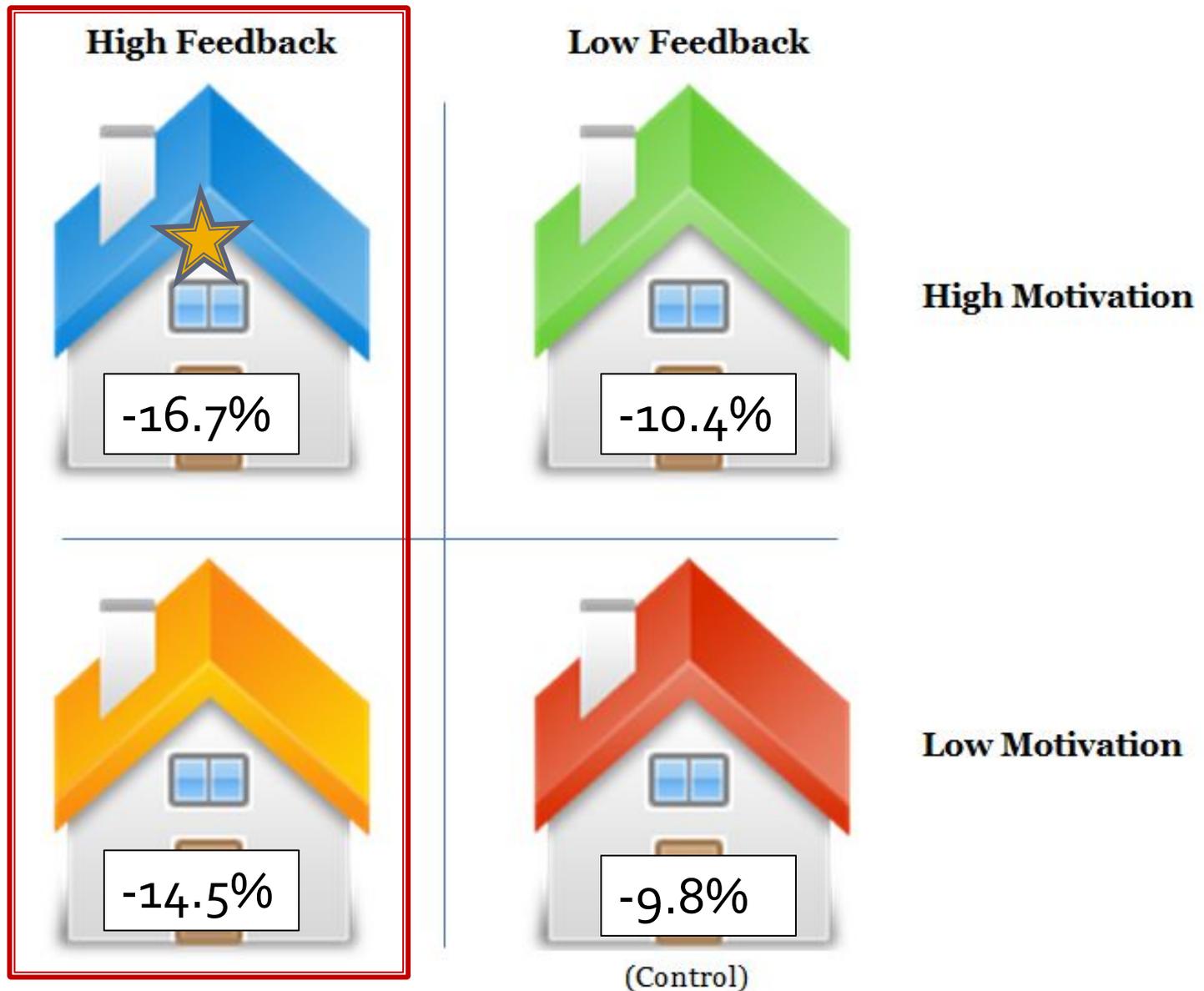
# The importance of feedback and motivation

## Shower Orb Example...

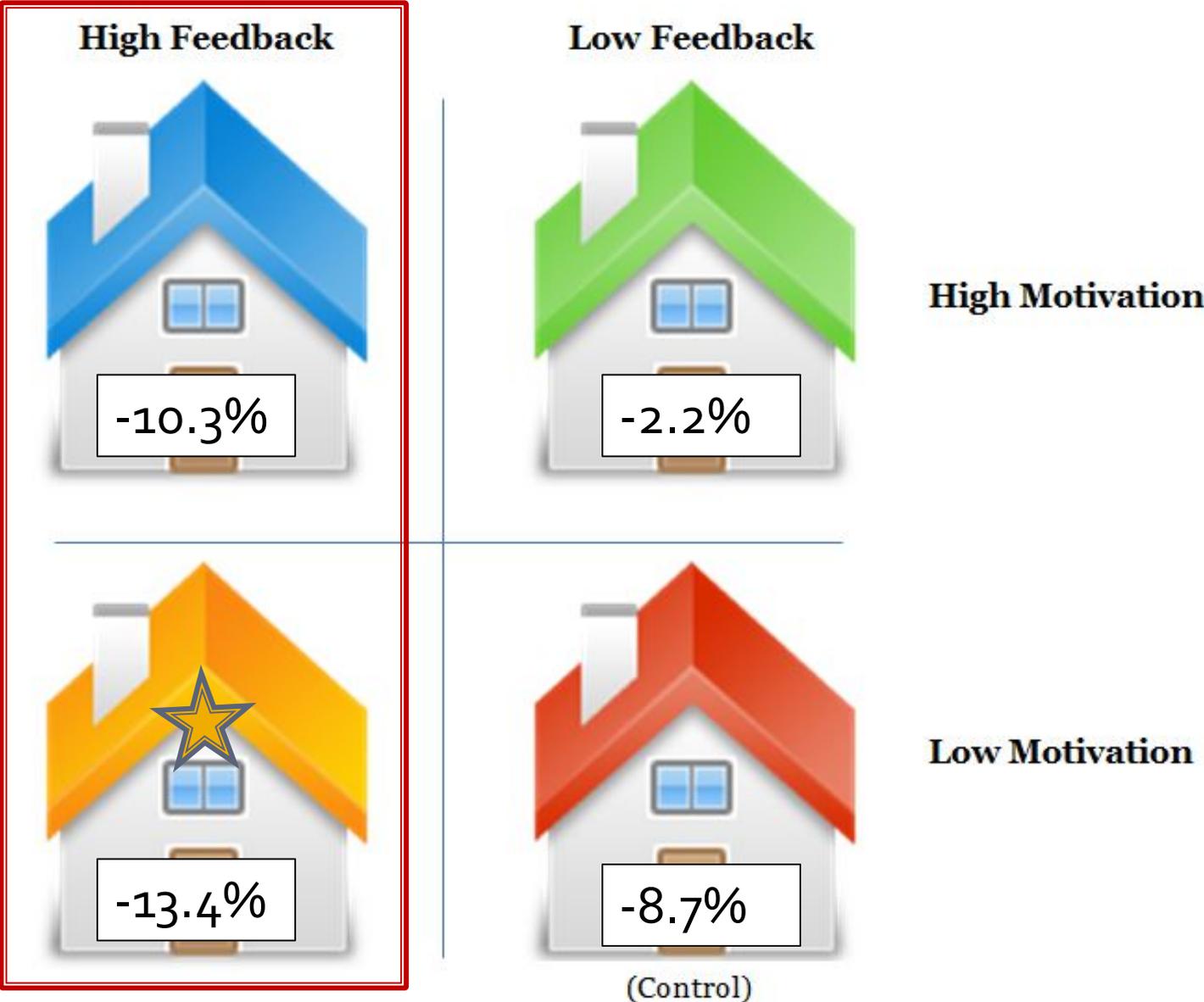
- Real time feedback on time in shower
- Green < 5 minutes; Yellow 6-8; Red 9 +
  - A cool device, but not enough...
- Motivation:
  - reminders of your own reasons to change behavior
- **Multiple** forms of feedback:
  - real-time: messaging, wall screens, dashboard, shower orb
  - static: wall screen / dashboard; reports



# Results: Electricity savings (first 2 years)



# Results: Water savings (first 2 years)



# The Next Step ...

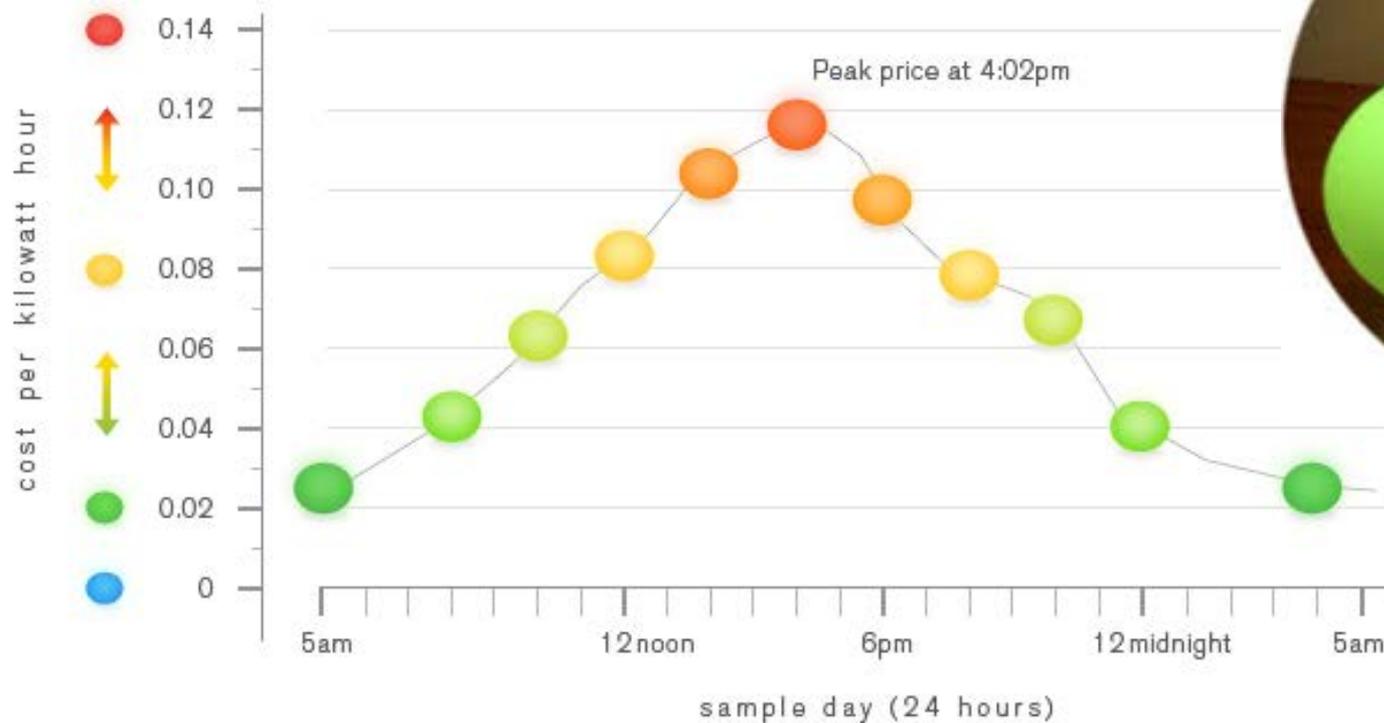
Can a Smart Housing approach work in low-income settings like large scale low-income housing?

Would it benefit low-income residents? How?

- Potential Benefits:
  - lifelong energy use education
  - potential savings benefit applied to other areas of need
- Can it work?
  - Often programs are deemed “too sophisticated” for low-income programs
    - an inherent prejudice
  - But the evidence says otherwise ...

# Consider the Energy-Smart Pricing Plan (ESPP) – Chicago '03-05

combined feedback and energy education



## Caveat:

This is *not* a split incentive problem... it simply demonstrates that low-income residents can effectively take part in complex energy consumer interactions

[http://www.eceee.org/library/conference\\_proceedings/ACEEE\\_buildings/2004/Panel\\_2/p2\\_29](http://www.eceee.org/library/conference_proceedings/ACEEE_buildings/2004/Panel_2/p2_29)  
<http://www.elevateenergy.org/wp/wp-content/uploads/MakingWavesintheHeartland.pdf>  
<http://www.cntprojects.net/repository/ESPP-2003-Evaluation.pdf>

# ESPP (run by Community Energy Cooperative, now CNT)

- highly popular
  - ~15% savings on average
- primarily low-income residents in Chicago
  - allowed real-time pricing to help low-income residents
  - showed that low income residents could adopt to more complex energy pricing regimes
- residents upset when pilot ended
  - IL later killed real time pricing

# Final Thoughts

1. Split Incentive problems can be addressed
2. Approaches that effectively marry incentives to both sides of the split incentive problem have real potential
  - e.g. on-bill financing with landlord incentives
3. Combined approaches of feedback with education / motivation have potential to be effective
  - e.g. feedback & motivation (Smart Housing)
  - or feedback, education, and economic incentive (ESPP)
4. Challenges:
  - adoption; investment; proven success for large scale implementation; regulatory commitment to experimentation and adoption

# Questions?

- Thanks very much...
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- Diana Hernández: [dh2494@columbia.edu](mailto:dh2494@columbia.edu)