Split Incentives in Low-Income Housing: Challenges and Solutions
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

1. Landlord Owner
2. Tenant Owner

3. Temporal
   - Efficiency investment to save money
   - May move soon, don’t want to lose investment

4. Utility
   - Utility profits from energy sales
   - Utility runs efficiency Programs
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.


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.)

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

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

<table>
<thead>
<tr>
<th></th>
<th>Residential Energy</th>
<th>22%</th>
<th>(33% of efficiency potential)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental Units</td>
<td>28%</td>
<td>22 * .28</td>
<td>6.16 %</td>
</tr>
<tr>
<td>Energy Assistance Eligible</td>
<td>35%</td>
<td>6.16 * .35</td>
<td>2.16%</td>
</tr>
<tr>
<td>Direct Energy Costs</td>
<td>88%</td>
<td>2.16 * .88</td>
<td>1.89%</td>
</tr>
<tr>
<td>U.S. Energy Expenditure</td>
<td>$1.06 trillion/yr</td>
<td>1.89 % *</td>
<td>$20 billion /yr</td>
</tr>
<tr>
<td>('09)</td>
<td>1.06 t</td>
<td>1.06 t</td>
<td>1.06 t</td>
</tr>
<tr>
<td>Range of Savings Possible</td>
<td>20-55%</td>
<td>* $20b</td>
<td>$4 – 11 b / yr</td>
</tr>
</tbody>
</table>
## Policy Responses for Split Incentives

<table>
<thead>
<tr>
<th>Description</th>
<th>Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contracts</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Green or energy efficiency lease | · Landlord/tenant agreement to conserve energy; retrofit investments are trickled down to tenant | · Landlord and tenant must cooperate  
· Ongoing maintenance necessary  
· Geared toward commercial leases |
| Energy efficiency mortgages (PACE) | · Externally funded loan attached to the property | · Benefits remain with the property and lien complicates property resale |
| On-bill financing | · Capital improvements are tied directly to utility company payments | · Usually focused on live-in homeowners, not tenants |
## Policy Responses for Split Incentives

<table>
<thead>
<tr>
<th>Description</th>
<th>Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regulation</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Green building codes | ⋅ Higher energy standards for new construction | ⋅ Only apply to new construction  
 ⋅ High cost creates bias against low-income tenants |
| Low-income rental mandate | ⋅ Mandate of higher energy standards for low-income housing | ⋅ Creates strong disincentive to provide low-income housing |
| **All-in Services** | |
| Weatherization Assistance Program | ⋅ National weatherization program, usually implemented as grants  
 ⋅ Differs from state to state | ⋅ Cannot be implemented at scale (cost);  
 ⋅ Inefficient; little maintenance  
 ⋅ Barely used for low-income rentals |
| Concierge services | ⋅ Small comprehensive programs combine efficiency with education | ⋅ Cannot be implemented at scale because of cost: highest expense |
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..

http://www.nyserda.ny.gov/All-Programs/Programs/On-Bill-Recovery-Financing-Program/FAQ
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)

<table>
<thead>
<tr>
<th>Loan amount:</th>
<th>$6000</th>
<th>$3800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing:</td>
<td>3% @ 15 years (interest rate subsidized)</td>
<td>0% @ 7 years (interest rate subsidized)</td>
</tr>
<tr>
<td>Financing cost per month:</td>
<td>$43</td>
<td>$45</td>
</tr>
<tr>
<td>Landlord incentive (month):</td>
<td>$10 (first 5 years)</td>
<td>$5 (first 4 years)</td>
</tr>
<tr>
<td>Projected savings (month):</td>
<td>$67 in electricity &amp; heating</td>
<td>$54 in electricity &amp; heating</td>
</tr>
<tr>
<td>Monthly savings for tenant:</td>
<td>$14 (first 5 years) $24 (years 6-15) $67 (years 16 and on...)</td>
<td>$4 (first 5 years) $9 (years 6-7) $54 (years 8 and on...)</td>
</tr>
<tr>
<td>Total Landlord incentive:</td>
<td>5 x $120/yr payments total: $600</td>
<td>4 x $60/yr payments total: $240</td>
</tr>
</tbody>
</table>
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
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: ~$350k
- Combined effects of
  - energy information / education
  - real-time feedback on resource use (email, internet “dashboard,” and apartment screen)
  - motivation and goal-setting (individual & group)

- 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

Repeat
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Breakdown</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electricity</strong></td>
<td>Lights, Outlets, Stove/Oven, Refrigerator, Other/Misc.</td>
</tr>
<tr>
<td><strong>Env. Quality</strong></td>
<td>CO/CO₂, Particulate Matter, Temperature, Relative Humidity</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>Hot, Cold, Overall</td>
</tr>
</tbody>
</table>

![Diagram of a house with labeled outlets and fixtures.](image)
Feedback Display & Online Dashboard

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: --.-- %
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

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

High Feedback
-16.7%
-14.5%

Low Feedback
-10.4%
-9.8%

High Motivation
Low Motivation
(Control)
Results: Water savings (first 2 years)

- High Feedback
  -10.3%
  -13.4%

- Low Feedback
  -2.2%
  -8.7% (Control)
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
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...
- Stephen Bird: sbird@clarkson.edu
- Diana Hernández: dh2494@columbia.edu