Encouraging sustainable practices beyond here and now: The case of programmable thermostats for low-income tenants

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Field experiment | North Albany Homes

Multifamily Housing

Income eligible

Focus group results
Like: Comfort, health, economic impact
Dislike: Irritating, complex, controversial

Facts.co
Albany, New York State
Field experiment | Schedule the thermostat according to familial lifestyles

158

3,5 months

December 2014 – March 2015

106 days
Field experiment | Recruitment

91% participated
8% of those opted out
Theoretical framework

Motivation to perform the behavior

Behavior is easy to do

Target behavior

Participants keep or use more programmable schedules and temperature setpoints

Adapted from the Fogg’s Model of Behavior Change

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BECC 2016 | Baltimore, October 2016
Research Questions
Field experiment | Research questions

Will residents be encouraged to keep their thermostats scheduled?
Field experiment  | Research questions

Will residents be encouraged to keep their thermostats scheduled?

Are those who commit to keep the schedules, more likely to use schedules?
Field experiment | Research questions

Will residents be encouraged to keep their thermostats scheduled?

Are those who commit to keep the schedules, more likely to use schedules?

Is the prompt a useful reminder to go back to using schedules?
Field experiment | Research questions

Will residents be encouraged to keep their thermostats scheduled?

Are those who commit to keep the schedules, more likely to use schedules?

Is the prompt a useful reminder to go back to using schedules?

On average, do tenants save energy?
Experimental Design
Before the field work | Activity on site
Field experiment | Control Group

Home interview
Field experiment | Prompt Group

Prompt

Programmed thermostat
Field experiment | Prompt & Commitment Group

Prompt

Programmed thermostat

Commitment
Field experiment | Randomized control trial

Control

Prompt

Prompt & Commitment
Group equivalency check

Groups were statistically similar before the beginning of the experiment

(Levene test confirms homogeneity and ANOVA p-value > 0.05)
Data Analysis | Temperature dataset

Temperature dataset for a week

Determining the number of days the schedules were used
Results
Results | Will residents be encouraged to keep their thermostats scheduled?

Average % of days with schedules

- Control: 6%
- Prompt: 37%
- Prompt & Commitment: 25%

Table 5: Total number of days in the experiment and number of days in schedule

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Total number of days in the experiment per group</th>
<th>Number of days in schedule per group</th>
<th>% in schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>3293</td>
<td>298</td>
<td>5.6%</td>
</tr>
<tr>
<td>Prompt group</td>
<td>3408</td>
<td>1248</td>
<td>36.6%</td>
</tr>
<tr>
<td>Prompt + Commitment group</td>
<td>4141</td>
<td>1020</td>
<td>24.6%</td>
</tr>
</tbody>
</table>
Results | Will those who commit keep more days in schedule?

<table>
<thead>
<tr>
<th>Groups</th>
<th>t</th>
<th>Df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Control” vs. “Prompt” groups</td>
<td>2.38</td>
<td>92</td>
<td>0.050*</td>
</tr>
<tr>
<td>“Control” vs. “Prompt + Commitment” groups</td>
<td>2.97</td>
<td>89</td>
<td>0.011*</td>
</tr>
<tr>
<td>“Prompt” group vs. “Prompt + Commitment” groups</td>
<td>0.44</td>
<td>90</td>
<td>0.897</td>
</tr>
</tbody>
</table>

* denotes statistical significance
Results | Is the prompt a useful reminder to go back to using schedules?

Percentage of schedule overrides for specific periods of time

- “Control” group
- “Prompt” group
- “Prompt + Commitment” group
Results | Is the prompt a useful reminder to go back to using schedules?

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Prompt</th>
<th>Prompt &amp; Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of days with schedules</td>
<td>6</td>
<td>39</td>
<td>26</td>
</tr>
</tbody>
</table>
Results | On average, do tenants save energy?

Control

Prompt

Prompt & Commitment

<table>
<thead>
<tr>
<th>Experimental Groups</th>
<th>Average indoor temp daytime (°F)</th>
<th>Average indoor temp nighttime (°F)</th>
<th>Average indoor temperature (°F)</th>
<th>% Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>73.6</td>
<td>74.1</td>
<td>73.8</td>
<td></td>
</tr>
<tr>
<td>Prompt</td>
<td>72.9</td>
<td>72.9</td>
<td>72.9</td>
<td>1.8%</td>
</tr>
<tr>
<td>Prompt + Commitment</td>
<td>73.3</td>
<td>73.3</td>
<td>73.3</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

\[1 - \frac{\text{Ave}T_{\text{ind}x}-\text{Ave}T_{\text{out}}}{\text{Ave}T_{\text{ind}G1}-\text{Ave}T_{\text{out}}}\]
Conclusions
Conclusions

- Results indicate that scheduling the thermostats with the preferences of the occupants and providing a prompt as a reminder to go back to using schedules helps participants save energy.

- Average daytime and nighttime indoor temperatures during the winter were significantly cooler than participants in the control group.

- Voluntary commitment didn’t result in an increased the use of programmed thermostat schedules.

- However, the households that committed to maintain their programmed schedules took more time to initially override their programmed thermostat settings.
Impact

RenewBoston

EmPower New York

Application in direct install campaigns
Aknowledgements

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Thank you for your time!

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