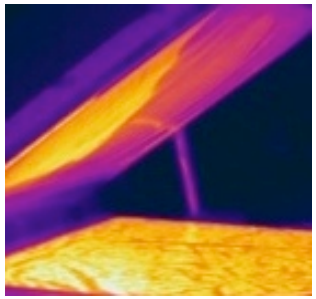
Encouraging sustainable practices beyond here and now: The case of programmable thermostats for low-income tenants



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BECC 2016
Baltimore, October 2016

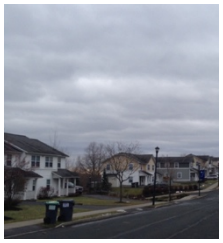
nyserda Energy. Innovation. Solutions. research into action inc Fraunhofer USA

Field experiment | North Albany Homes

Facts.co

Albany, New York State

Multifamily Housing



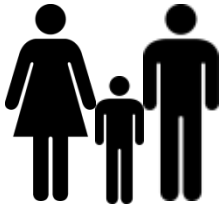
Income eligible

Focus group results

Like: Comfort, health, economic impact

Dislike: Irritating, complex, controversial

Field experiment | Schedule the thermostat according to familial lifestyles



158

3,5 months

December 2014 – March 2015

106 days

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Field experiment | Recruitment

91% participated

8% of those opted out

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Theoretical framework

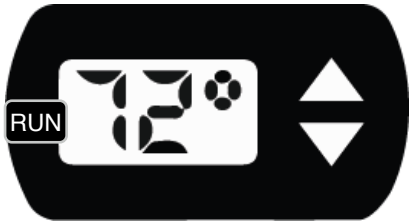
Commitment

Target behavior

Participants keep or use more programmable schedules and temperature setpoints

Motivation to perform the behavior

Prompt



Simplifying by scheduling the Thermostat

Behavior is easy to do

Adapted from the Fogg's Model of Behavior Change

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Research Questions

Field experiment | Research questions

Will residents be encouraged to keep their thermostats scheduled?

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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?

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Field experiment | Research questions

Will residents be encouraged to keep their thermostats scheduled?

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

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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

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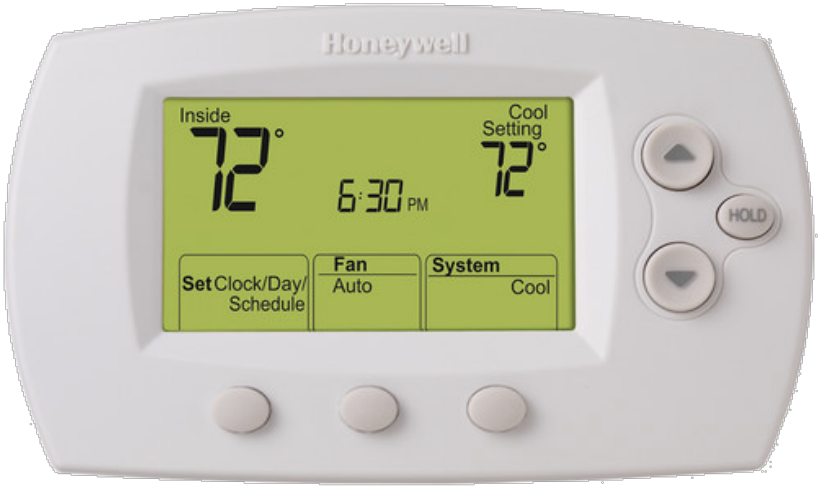

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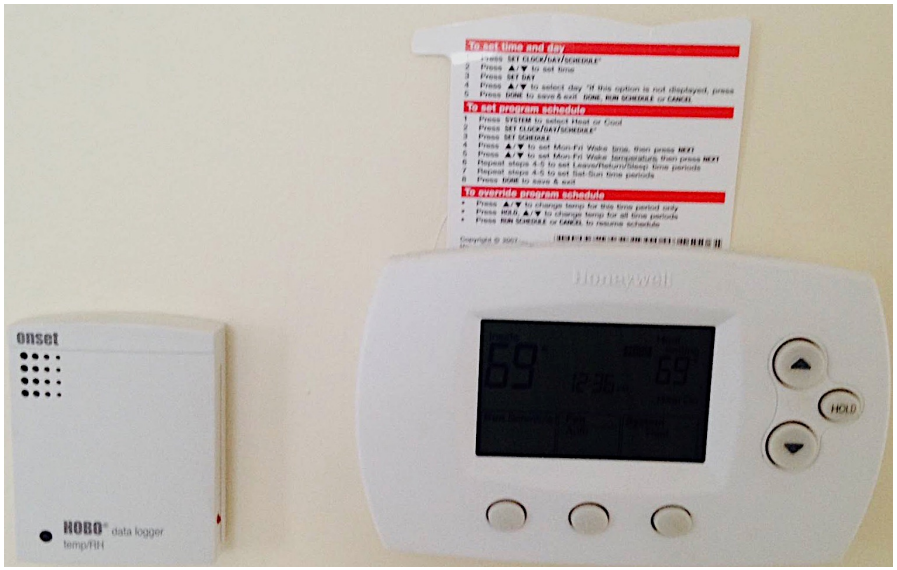
Field experiment | Control Group

Home interview



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Field experiment | Prompt Group

Home interview

Prompt

Programmed thermostat

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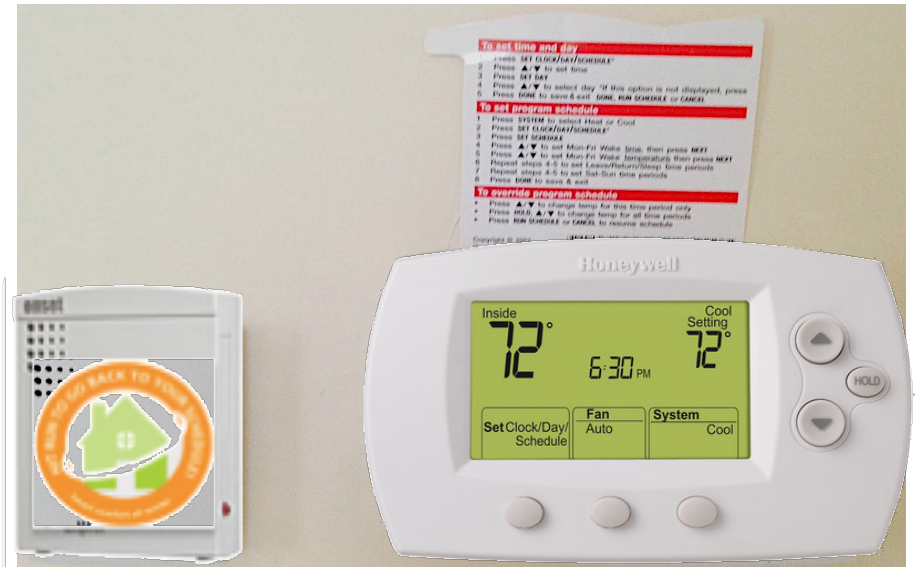
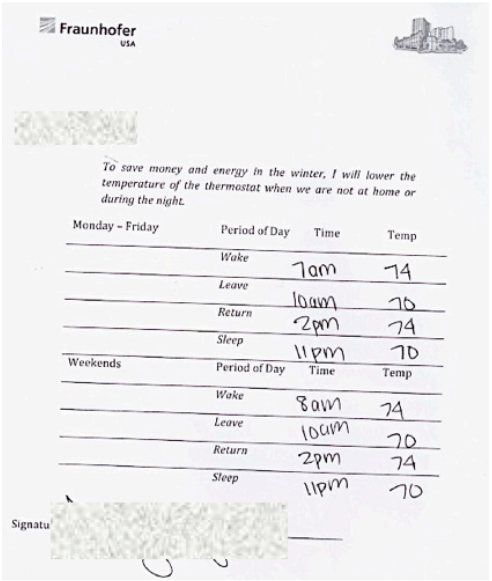
Field experiment | Prompt & Commitment Group

Home interview



Prompt

Programmed thermostat



Commitment

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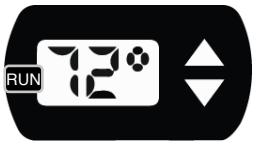
Field experiment | Randomized control trial

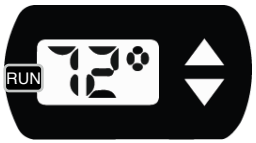
Control

45

Prompt

40

Prompt & Commitment

45

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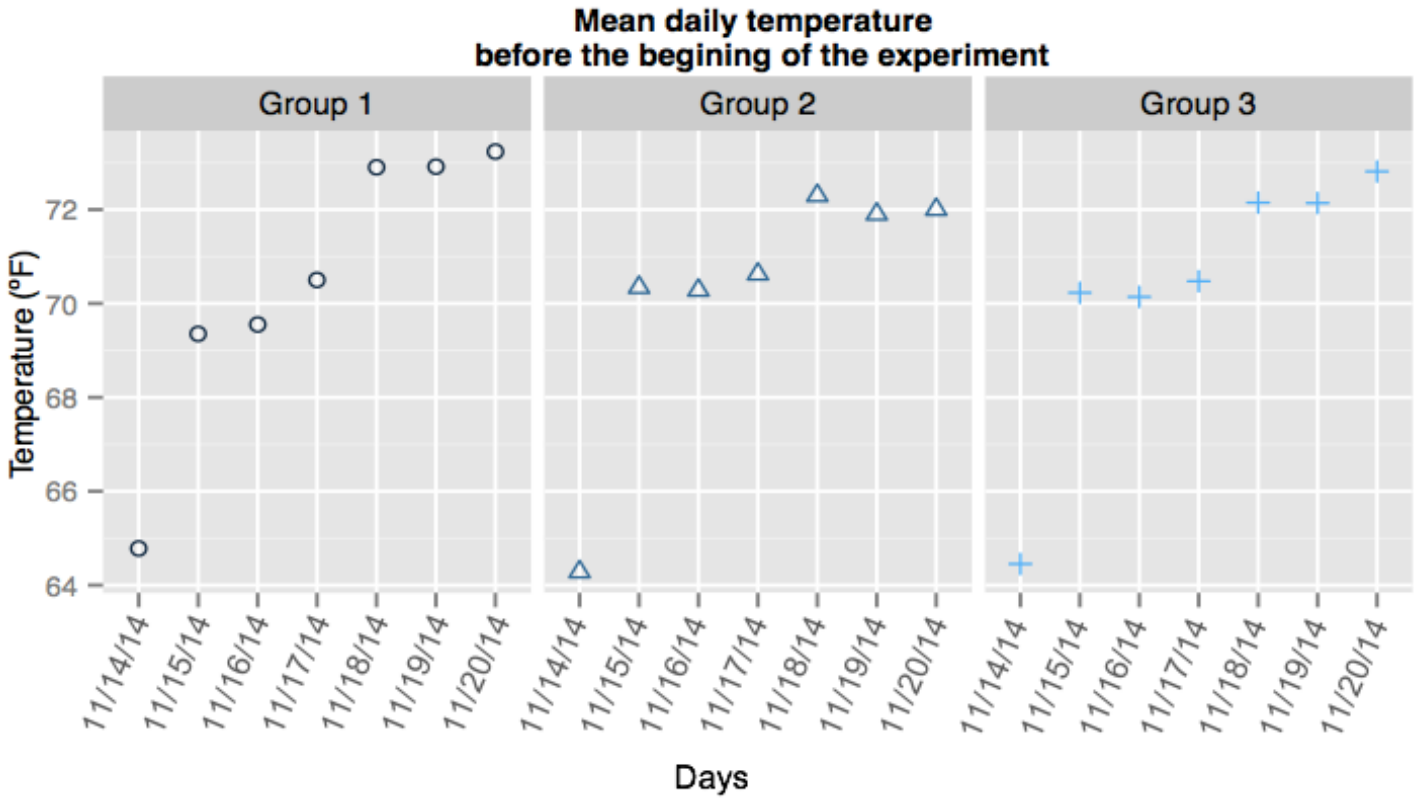
Analysis

Group equivalency check

Groups were statistically similar before the beginning of the experiment



(Levene test confirms homogeneity and ANOVA p-value > 0.05)

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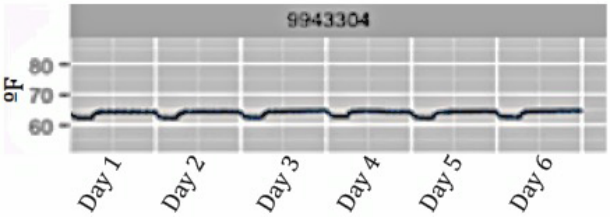
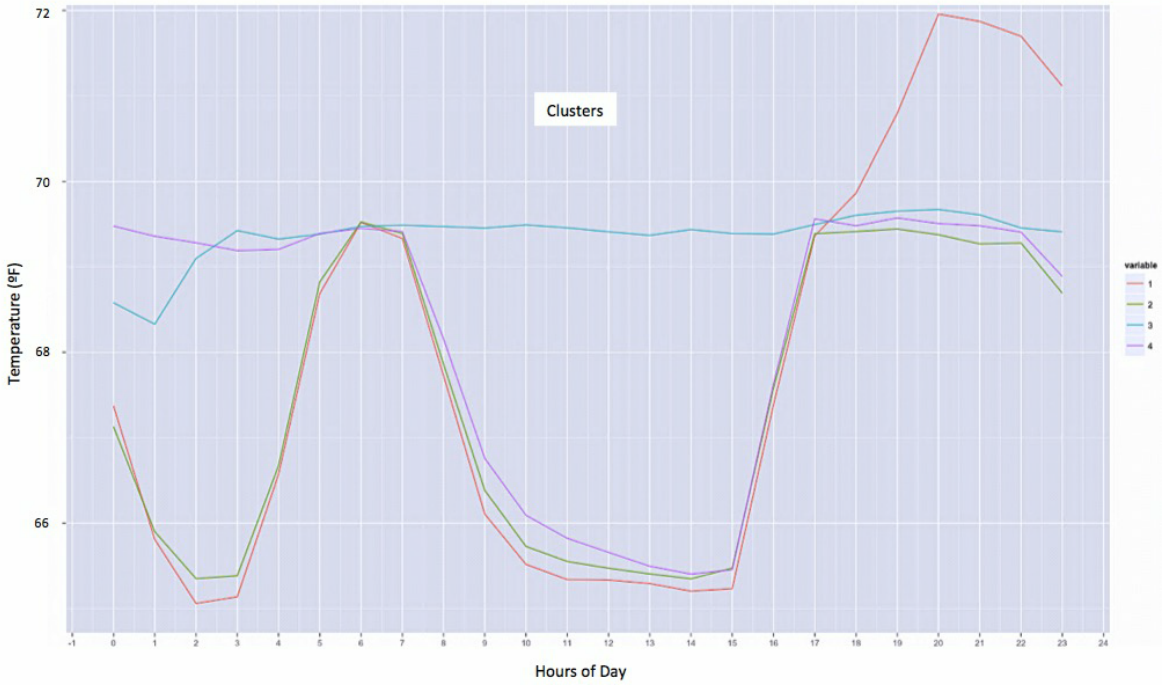
Data Analysis | Temperature dataset



Temperature dataset for a week

Determining the number of days the schedules were used



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Results

Results | Will residents be encouraged to keep their thermostats scheduled?

Control

Prompt

Prompt & Commitment

Average % of days with schedules

Control	Prompt	Prompt & Commitment
6 %	37 %	25 %

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

Dataset	Total number of days in the experiment per group	Number of days in schedule per group	% in schedule
Control group	5293	298	5.6%
Prompt group	3408	1248	36.6%
Prompt + Commitment group	4141	1020	24.6%

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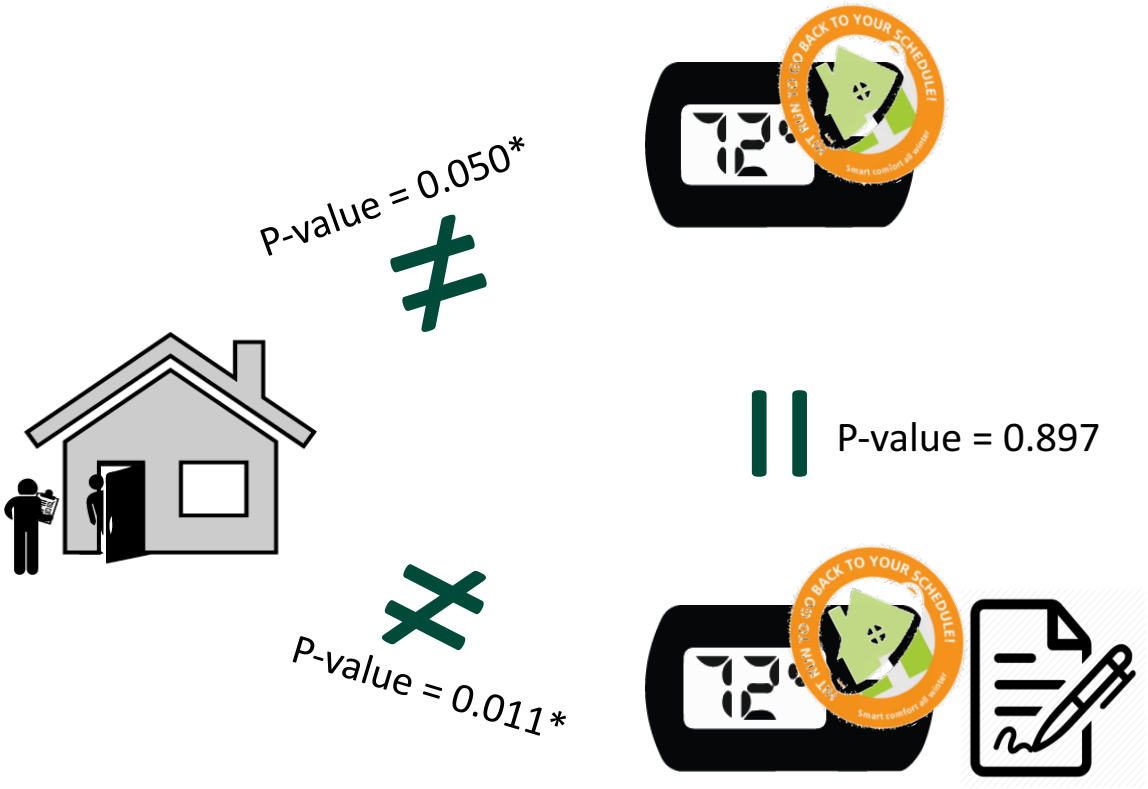
Results | Will those who commit keep more days in schedule?



*denotes statistical significance

Table 8. Two by two comparison

Groups	*t*	Df	*p-value*
"Control" vs. "Prompt" groups	2.38	92	0.050*
"Control" vs. "Prompt + Commitment" groups	2.97	89	0.011*
"Prompt" group vs. "Prompt + Commitment" groups	0.44	90	0.897

*$p<0.05$, ** $p<0.01$, ***$p<0.001$

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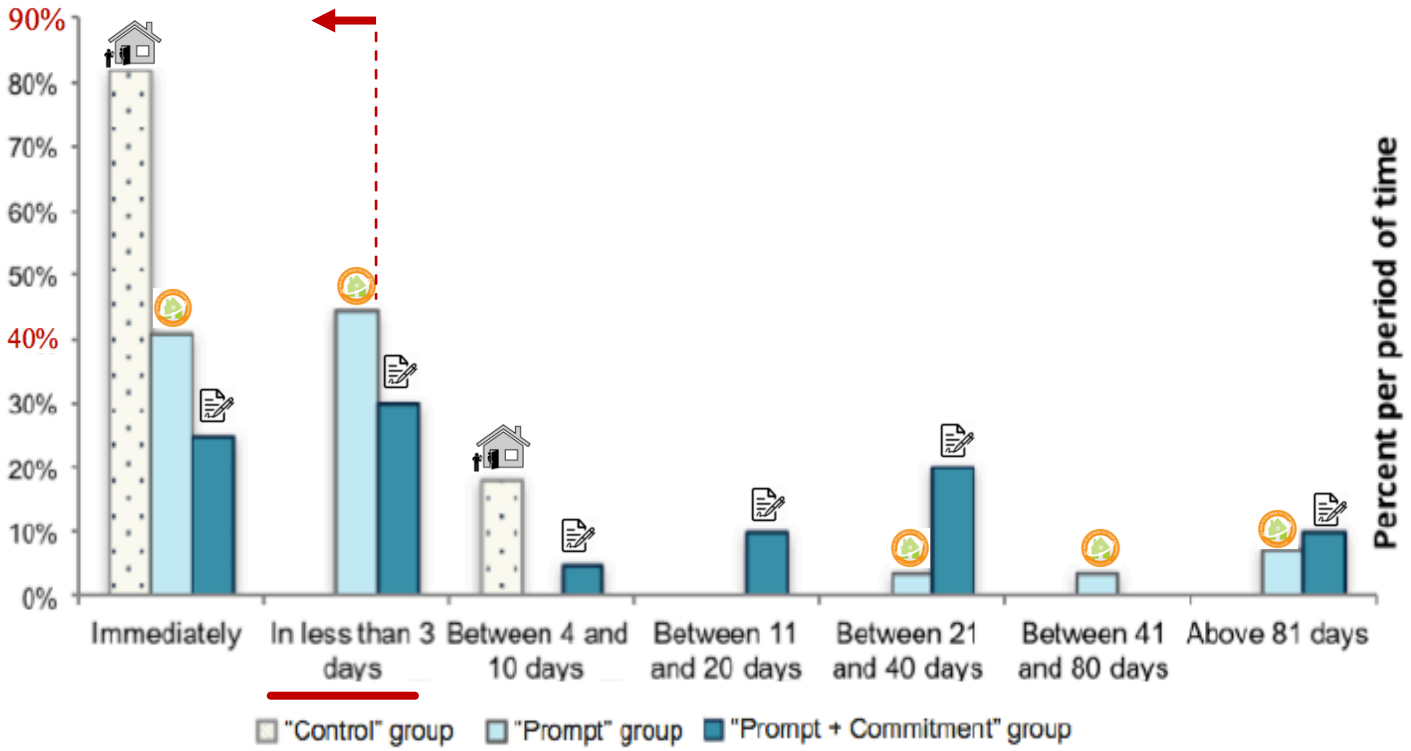
Results | Is the prompt a useful reminder to go back to using schedules?

Percentage of schedule overrides for specific periods of time



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

Control

Prompt

Prompt & Commitment

	Control	Prompt	Prompt & Commitment
Average number of days with schedules	6	39	26

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Results | On average, do tenants save energy?

Control

2 %

Prompt

1 %

Prompt & Commitment

Table10: Percent savings for "Prompt" and "Prompt + Commitment"

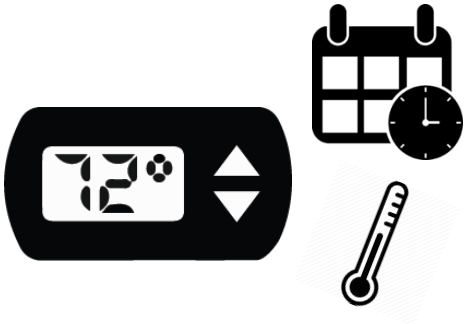
Experimental Groups	Average indoor temp daytime (°F)	Average indoor temp nighttime (°F)	Average indoor temperature (°F)	% Savings
Control	73.6	74.1	73.8	
Prompt	72.9	72.9	72.9	1.8%
Prompt + Commitment	73.3	73.3	73.3	1.1%

$$\left[1 - \frac{AveT_{indx} - AveT_{out}}{AveT_{indG1} - AveT_{out}}\right]$$

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**
- 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



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Impact

Renew Boston

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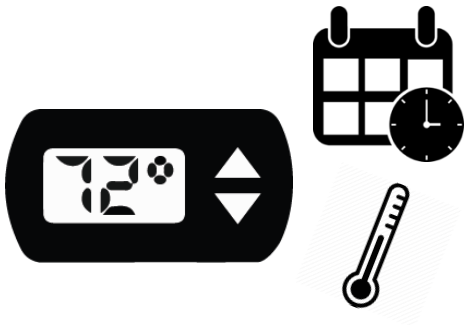
Application in direct install campaigns



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Thank you for your time!

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