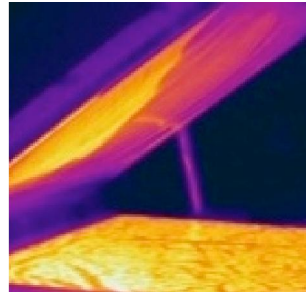# Encouraging sustainable practices beyond here and now: The case of programmable thermostats for low-income tenants
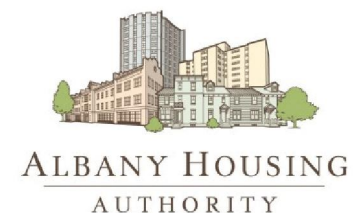
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BECC 2016
Baltimore, October 2016
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ALBANY HOUSING AUTHORITY

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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

    BECC 2016 | Baltimore, October 2016   2

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

Motivation to perform the behavior (y-axis)

Behavior is easy to do (x-axis)

Commitment

Target behavior: Participants keep or use more programmable schedules and temperature setpoints

HIT RUN TO GO BACK TO YOUR SCHEDULE! Smart comfort all winter

Prompt

RUN 72°

Simplifying by scheduling the Thermostat

Adapted from the Fogg's Model of Behavior Change

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Research Questions

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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?

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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?

Field experiment | Research questions

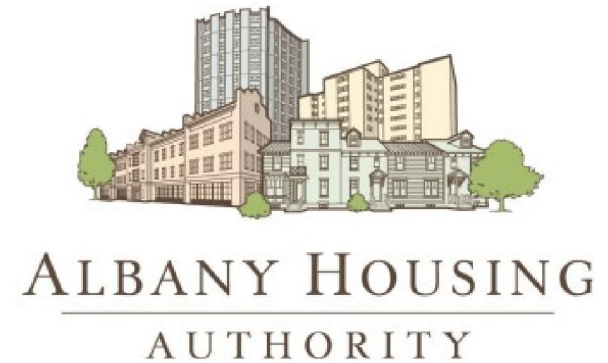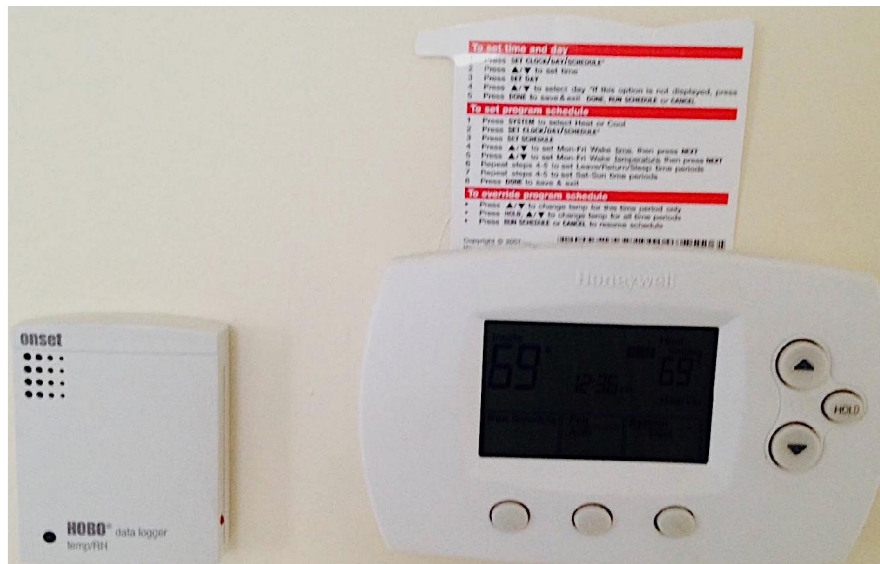Will residents be encouraged to keep their thermostats scheduled?

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

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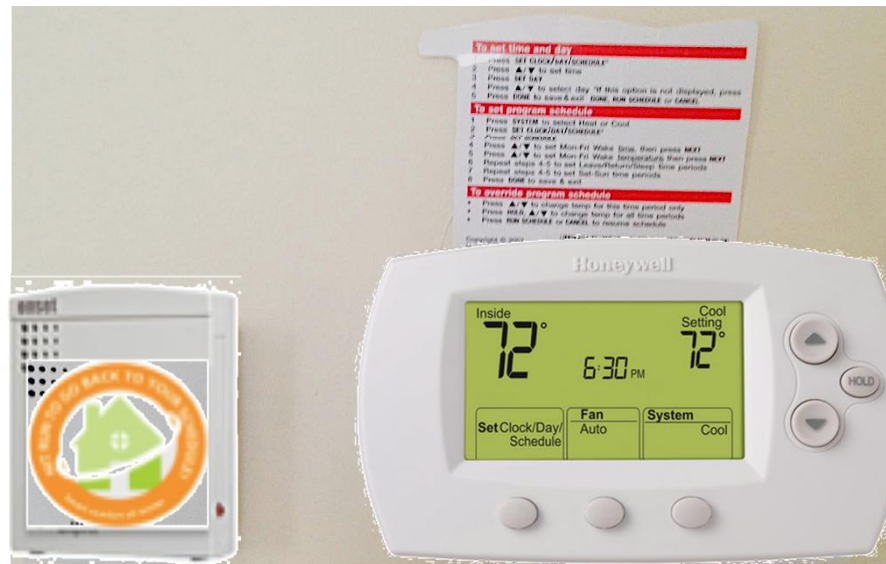**On average, do tenants save energy?**

Experimental Design

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Before the field work | Activity on site
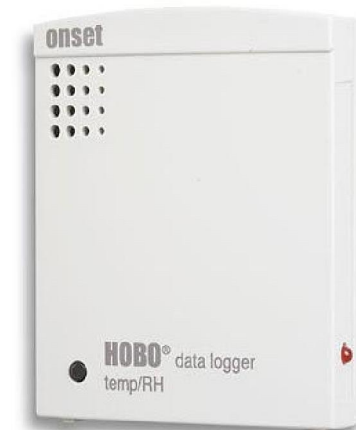
Field experiment | Control Group

Home interview

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

Analysis

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Group equivalency check

Groups were statistically similar before the beginning of the experiment

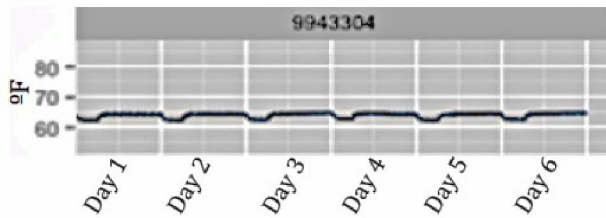**Mean daily temperature before the begining of the experiment**
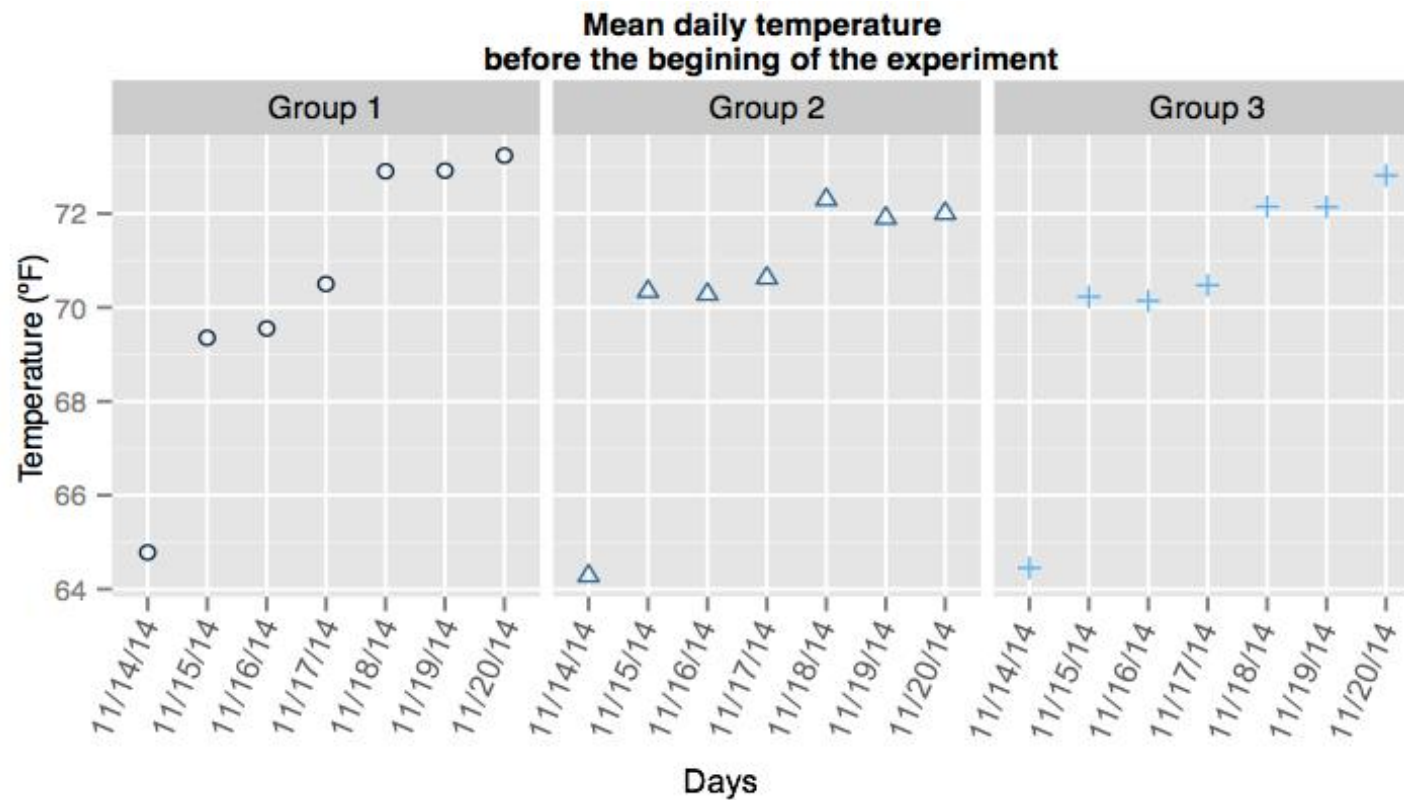
(Levene test confirms homogeneity and ANOVA p-value > 0.05)

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Data Analysis | Temperature dataset

Temperature dataset for a week

Determining the number of days the schedules were used

Results

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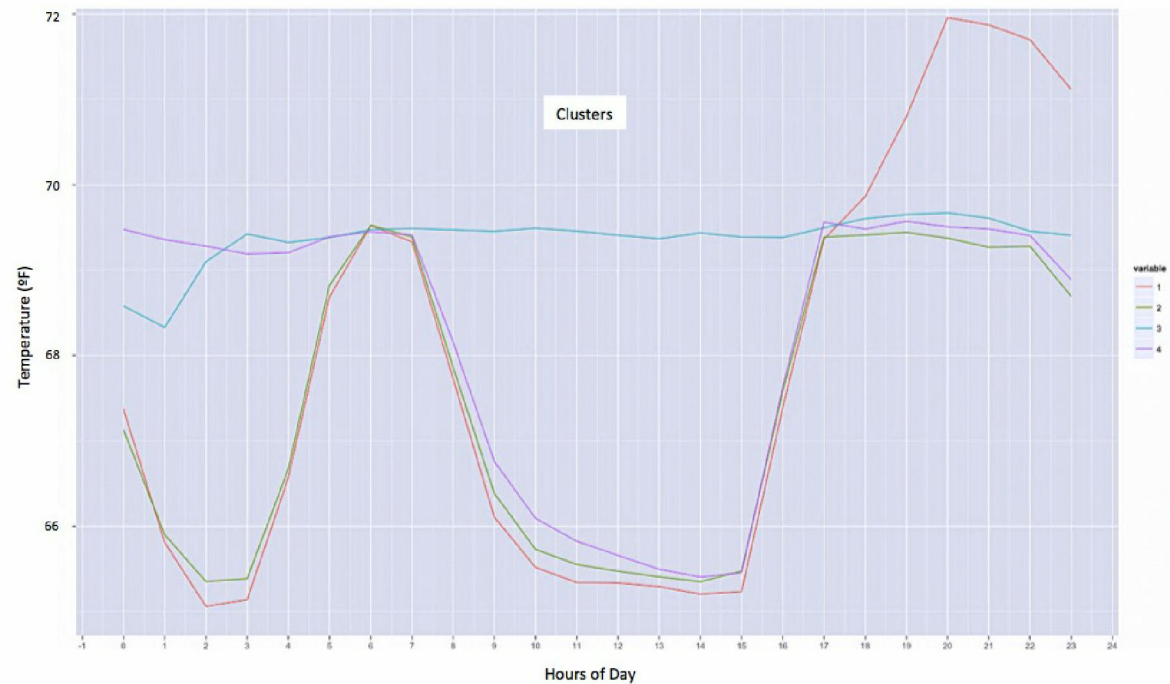
Results | Will residents be encouraged to keep their thermostats scheduled?

Control

Prompt

Prompt & Commitment

**Average % of days with schedules**

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?

P-value = 0.050*

P-value = 0.897

P-value = 0.011*
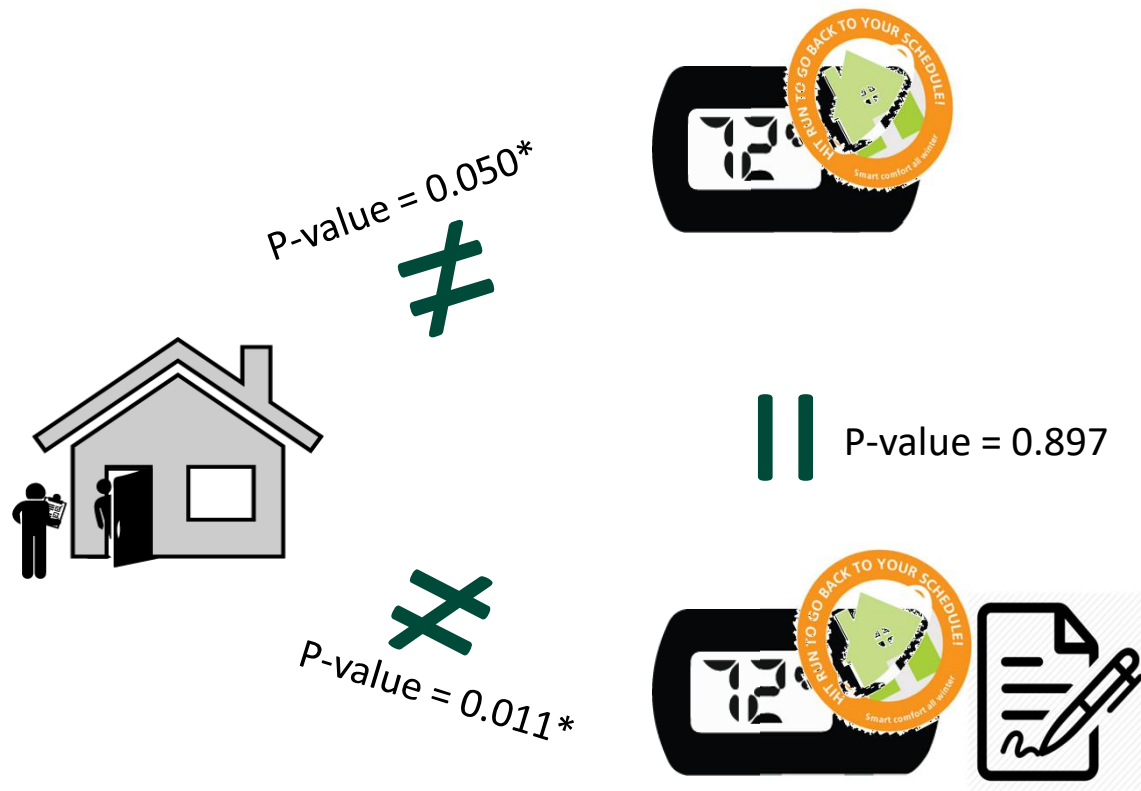
*denotes statistical significance

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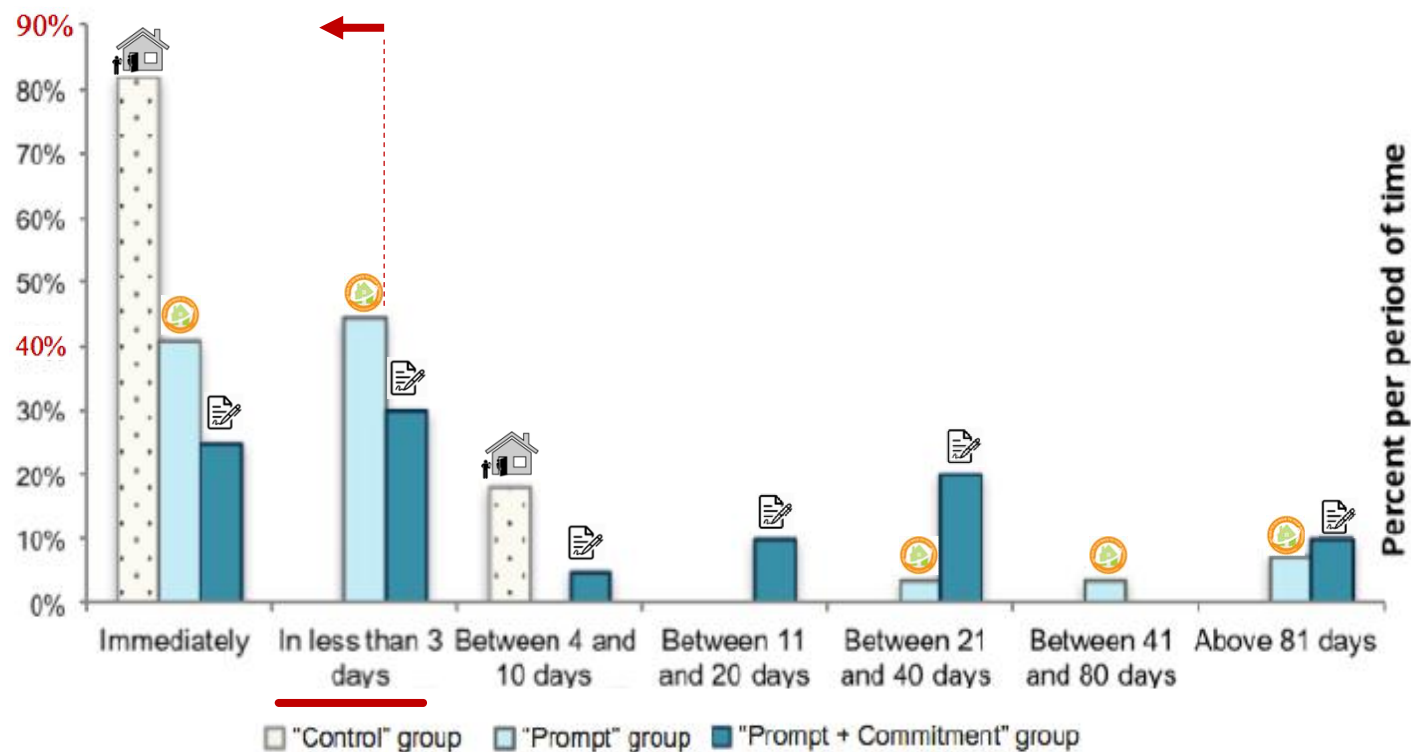
Results | Is the prompt a useful reminder to go back to using schedules?

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

Results | On average, do tenants save energy?

2 % → **Prompt**

Control
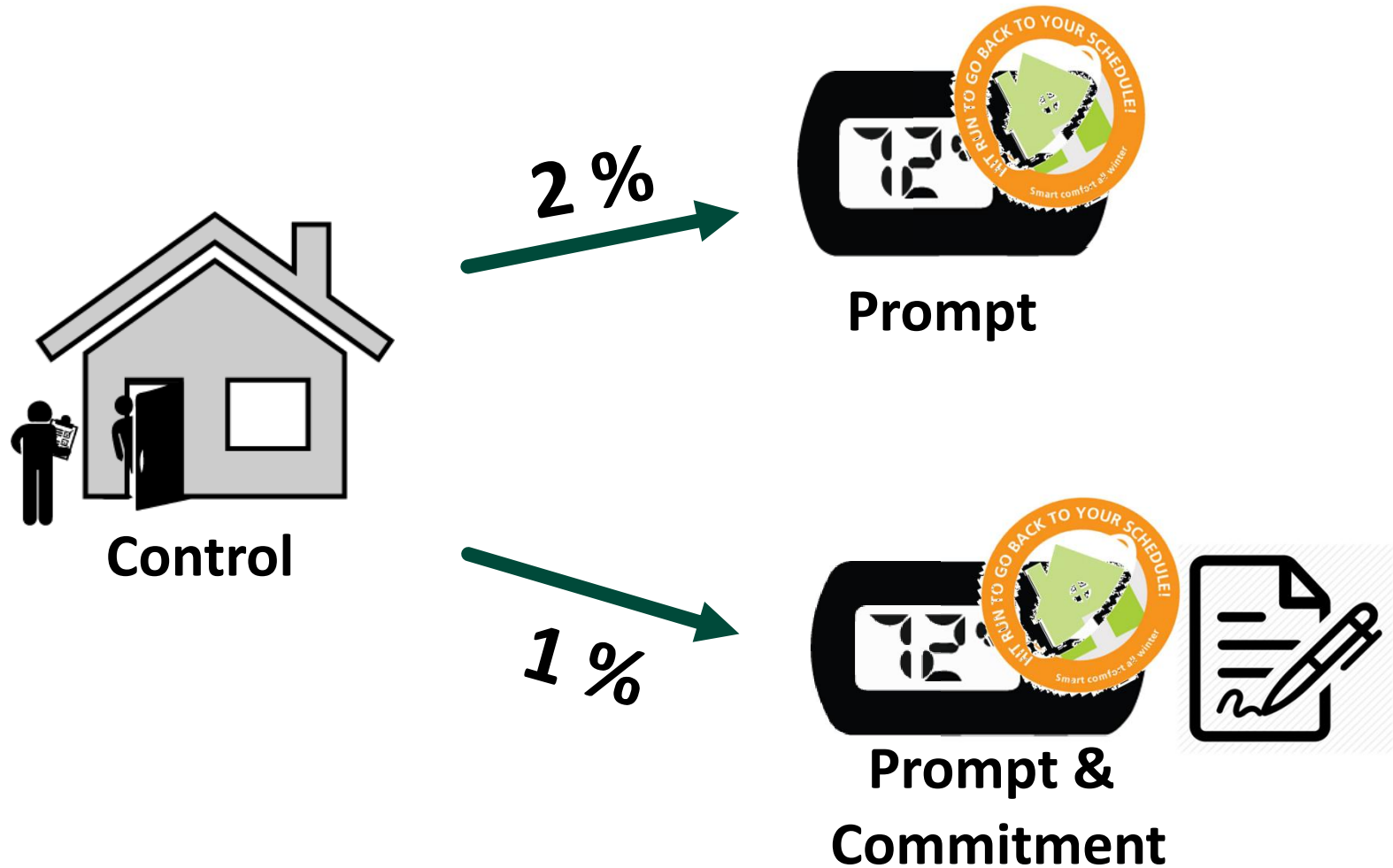
1 % → **Prompt & Commitment**

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

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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
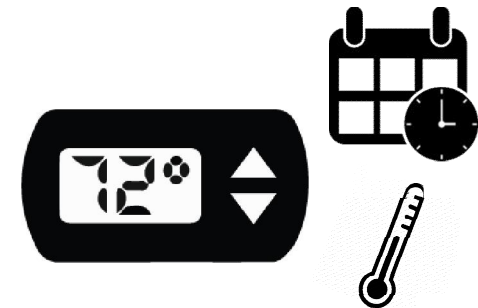
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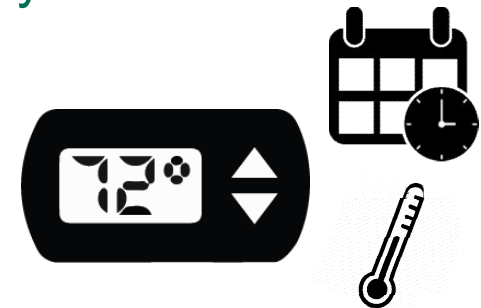
Impact

Renew Boston

GREENOVATE BOSTON

EmPower New York

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Application in direct install campaigns

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Aknowledgements

Marsha Walton, NYSERDA
Alex Dunn, Jane Peters and Meghan Bean, RIA
Laura Moody, AHA
Michael Zeifman, Kurt Roth, Kaitlin Lehman, Anne Williams, Claire McIlvennie, Alliston Watts, Fraunhofer
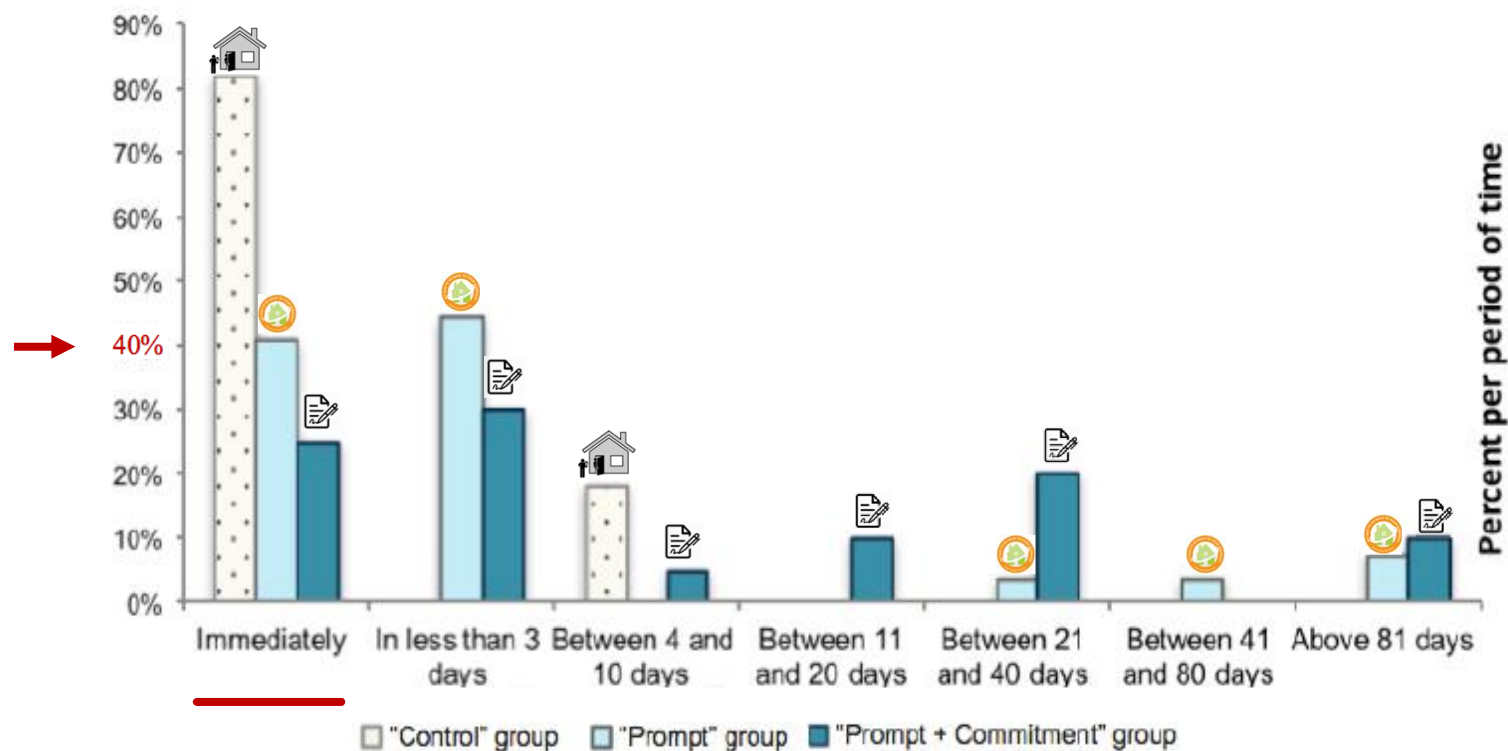
Thank you for your time!

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