Getting Smarter?
Evidence of Savings from the Nest Thermostat

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Sacramento, California

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Overview
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Hurdles encountered along the way
Research Objectives
1. Estimate Savings
   - Gas (SoCalGas) and electric (Southern California Edison, Los Angeles Department and Water and Power, and Water and Power, City of Pasadena)
   - 2014/2015 winter, 2014 summer
   - Percent of total usage, percent of heating/cooling load, typical meteorological year

2. Customer Response
   - Survey of participating and non-participating customers
   - Willingness-to-pay for a smart thermostat

3. General Application of Findings
   - Comparison of thermostat data across pilot population, general population
Pilot Implementation
Pilot Implementation

All Households

Target Population

- AMI
- Geographic targeting: Inland Empire, Palm Springs, Central LA, and the San Fernando Valley
- Excluded top and bottom 10%
Pilot Implementation

All Households

- Screened Out

Target Population

- Screened In

- Do Not Opt In

- Opt In

- Direct mail and two email campaigns
- December 2013 through July 2014
- Free Nest thermostat with installation

SoCalGas
A Sempra Energy utility
Pilot Implementation

- Single family residence, homeowner
- Gas furnace, central air conditioning
- One thermostat with wiring compatible with the Nest
- Wireless network and knowledge of wireless network ID and password
- Lived in residence for previous 12 months and plans to live in residence for next 12 months
- Customer must authorize release of billing data

<table>
<thead>
<tr>
<th>Eligible</th>
<th>Not Eligible</th>
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<tr>
<td>785</td>
<td>1,793</td>
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Pilot Implementation

All Households → Target Population

- Screened Out
- Screened In
- Opt In
- Do Not Opt In
- Eligible
- Not Eligible

- Assigned to treatment and control groups in sequence to ensure large enough group of participants
- Random sample of target population for each mailing campaign
- Installations took place December 2013 through May 2014

503
282
Pilot Findings
Pilot Findings: Randomization

- Comparison of average daily therm usage in 25 months preceding pilot
- Significant differences identified in 8 of 25 months
- Approximately 0.1 therm difference (or 7% of average usage)
- Driven by geographic differences
Pilot Findings: Gas Savings

- Tested various modeling approaches to account for geographic differences
- Match on pre-usage and include a spatial fixed effect
- Power analysis suggests sample size of 5,000 was required
- Unusually mild winter in 2014/2015
Pilot Findings: Gas Savings

- Relatively few studies
- Gas savings range from 0% to 12% for Tier III thermostats
In Closing
Nest thermostats seem to provide measurable gas savings

Lessons learned include
- There are many challenges associated with thermostat evaluations
- Tradeoff between internal and external validity, as well as feasibility of implementation
- Each new study provides better information for the next

Next Steps
- Electricity savings for summer period are currently being estimated
- Assess customer satisfaction and willingness-to-pay for a smart thermostat
- Obtain data from Nest to develop better insight into pilot population and compare to general population of Nest owners
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