

Switches vs. Thermostats

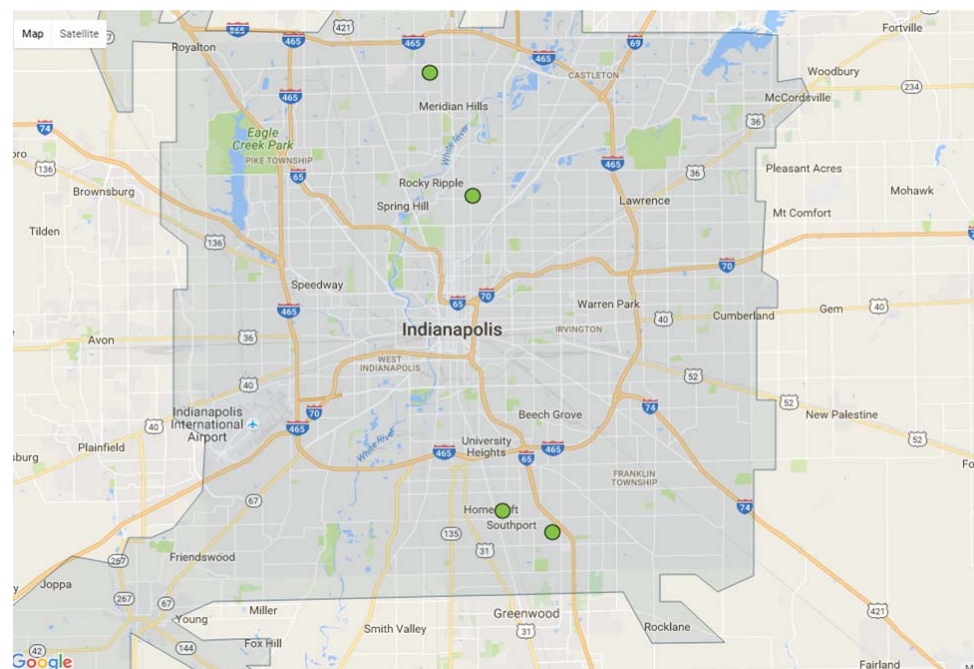
What role does behavior play in terms of demand savings?

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IPL Service Territory

- Serves approximately 480,000 electric customers
- 528 square mile service territory
- 99% coverage through existing AMI network



Study Introduction

- Objective: Identify whether or not smart thermostats could serve as a cost-effective addition to IPL's existing CoolCents' load control switch program
- The Pilot was designed to compare performance across the following parameters:
 - Event device performance
 - Event opt-out rates
 - Load reduction (results available in Q2)
- Random recruitment of participants support a relatively unbiased comparison across devices

CoolCents Program Overview

- Serves residential and small commercial customers
- Deployed for economic benefits
- Offers a range of technologies

Device	Year Started	Participants
One Way Switch	2003	48,742
Two Way Switch	2015	198
Smart Thermostat	2016	95

Device Performance and Opt-Outs

How do switches and thermostats differ?

Device Performance Rates

- Non-participation rates, or failures, are relatively similar across the two piloted technologies

Switch and Smart Thermostat Pilot Device Non-Participation Rates

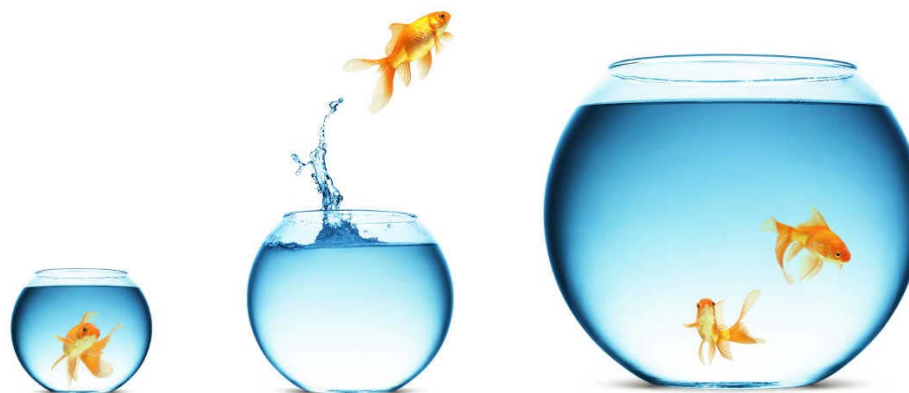
Adjusted Demand Reduction	Device Non-Participation Rate
Smart Thermostat (2016)	9%
Two Way Switch (2015)	11%

Smart Thermostat Opt-Out Rates

- On average, 21% of smart thermostat participants opt-out during an event, which is much higher than switch opt-out rates (<1%)
 - However, most smart thermostat opt-outs occur *part-way* through an event, meaning that opt-out participants still contribute to overall demand reduction
 - Smart thermostat participants who opt-out complete, on average, 56% of the event (or 2 hours) before opting out, for an average 4 hour event
- Future modeling can be done to calculate the size of this 'lost' demand savings

What trends do we see with opt-outs?

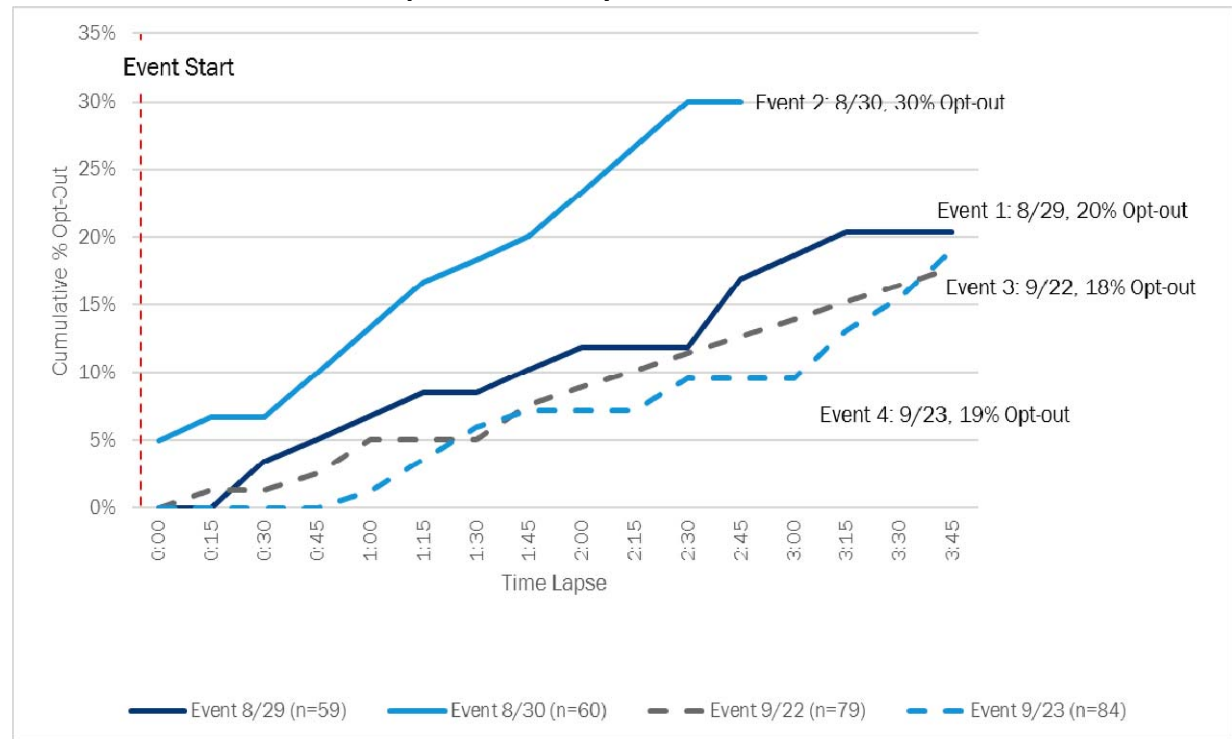
- Across all four events:
 - 62% of smart thermostat participants never opted-out
 - 29% sometimes opted-out of events
 - 9% always opted-out



When do they opt-out?

- We would expect to see an increasing rate of opt-outs as events progress
- However, the opt-out rate remains consistent over the event period

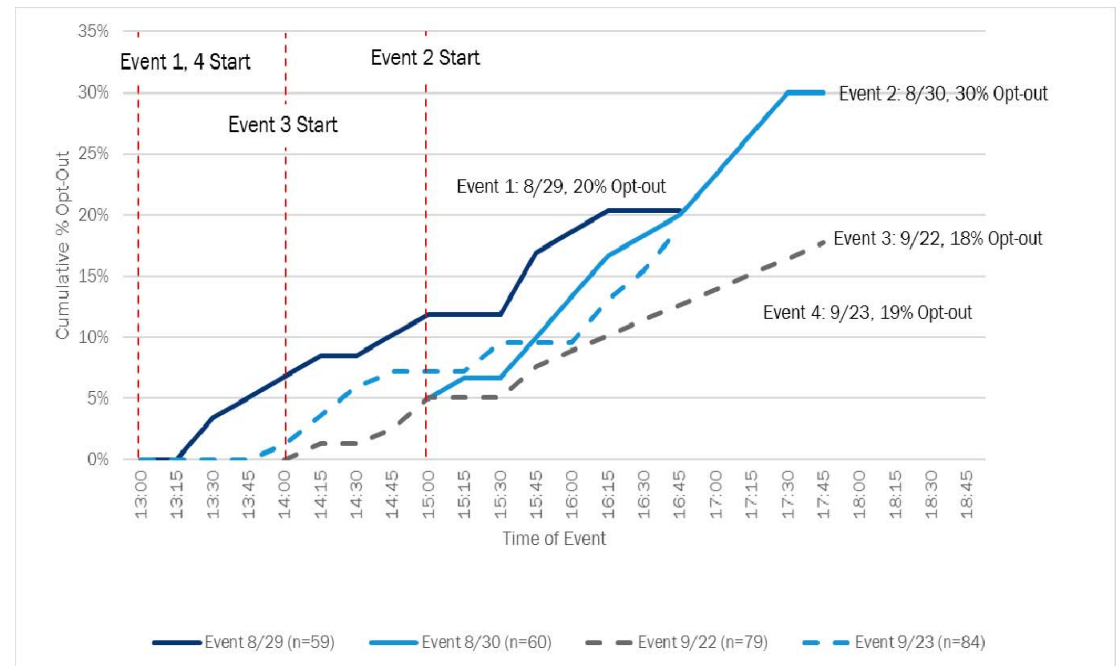
Opt-outs by Event Duration



When do they opt-out?

- We would expect to see variation in opt-outs based on when events are called
- However, the opt-out rate remains consistent over the event period no matter when the event occurred

Opt-outs by Time of Day



Why do they opt-out?

- Two key drivers:
 - Participant Comfort
 - Participants who prefer cooler homes tend to opt-out
 - Participants in homes with less thermal integrity tend to opt-out
 - Thermostat Engagement
 - Frequent engagement with the thermostat is correlated with opt-out behavior

“One time we were here and it was really, really warm so I did nudge the temperature down a little bit, because it was like 86 in the house and humid. It's just warmer when they do the events; it's fine, because we know that it is helping IPL and they were kind enough to get the smart thermostat installed and setup. It was around 5:30 that I'm guessing that we changed it, so we probably had 30-45 min left in the event.” -- Respondent

Why do they opt-out?

- Are there other factors?
 - Household Occupancy Patterns
 - Participants who always opt-out are more likely to be at home
 - Participants who opt-out blame other household members who were home at the time
 - Event Awareness
 - Interviews suggest that most respondents were aware that an event was occurring
- Additional data (occupancy) and research (customer surveys) can provide greater insights

"Going to have to assume that it was my wife, because I don't think that I opted out of any of them [the events]. She made a comment [about the house being warm], she probably did override it at least once, and my kids might have overridden it as well."-- Respondent

Recommendations: Reduce number of participants who opt-out

- Strategies to mitigate opt-out behavior should focus on two goals:
 - 1) Reduce number of participants who opt-out
 - 2) Extend time before participants opt-out
- Serial opt-outs tend to be the same types of customers:
 - They prefer creature comforts (e.g., cooler homes)
 - Have homes with less thermal integrity
- Recommend that these programs offer customers:
 - Strategies to minimize discomfort during events (e.g., use shades, etc.)
 - Target customers identified to have less thermal integrity for EE weatherization program

Recommendations: Goal 2: Extend time before participants opt-out

- Leverage behavioral strategies to motivate customers to complete events, via information provision, comparative messaging and goals
 - Before the events:
 - Set goals for customers to complete events
 - Provide educational materials to all household members explaining the purpose of demand response events
 - During the events:
 - Send reminders of an 'event in progress' during typical opt-out time frame
 - After the events:
 - Provide event performance feedback to participants
 - Provide feedback compared to peers
 - Thank customers for their participation

What is IPL considering in terms of mitigating opt-outs?

- Carrots or sticks
 - Performance-based incentives
 - Retention bonus
- Enhancing customer experience
 - Education regarding what the device does during events and how they contribute to IPL

What other benefits can be derived?

- Energy efficiency savings
- Driver to participation in other EE programs
- Identifying good candidates to weatherization or equipment replacement or testing (HVAC) programs
- Non-event load shift
- Customer satisfaction and engagement with utility

Questions & Contact

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Smart Thermostat Event Information

Smart Thermostat Pilot Event Details

Event Date	Day of Week	Start Time	End Time	Average Event Temp (F)	Max Event Temp (F)
August 29	Monday	1:00 pm	5:00 pm	87	88
August 30	Tuesday	3:00 pm	6:00 pm	87	88
September 22	Thursday	2:00 pm	6:00 pm	85	86
September 23	Friday	1:00 pm	5:00 pm	86	87

Satisfaction

- Respondents were:
 - Highly satisfied with the device and the program
 - Likely to recommend the pilot and device to others (average likelihood scores of 8.6 and 9.2 out of 10, respectively where 10 is “very likely”)
 - Positive increase in the respondents’ opinion of IPL

“For them [IPL] to spend the money and take the effort to put something in my house that helps peak demand and helps me save money on my energy bill, I think that’s fantastic.” -- Respondent