Data-driven Assessment of Energy Efficiency Investment Behaviors of Midwest Residential Homeowners

OBJECTIVES:
The goal of this project is to assess the investment behaviors of residential homeowners in energy efficient technologies and retrofits including: - HVAC Equipment - Lighting - Large Appliances - Insulation

How many energy efficiency investments do homeowners make?

What energy efficient investments are the most common? Which are made first?

How much does a homeowner typically pay for upgrades?

BACKGROUND:
In the United States, buildings account for a significant amount of the following, over half of which is from residential buildings: - 39% of total energy use - 74% of total electricity consumption - 38% of the carbon dioxide emissions

There is an established “energy efficiency gap” between possible savings and actual realized savings in buildings.

Utility companies offer rebate programs to incentivize energy savings retrofits. However often these programs are not fully taken advantage of.

A better understanding of the energy efficiency investment behaviors of homeowners can provide insights into how to better motivate homeowners.

METHODOLOGY:
Collaborative partnership between Iowa State University and Cedar Falls Utilities for the city of Cedar Falls

1) Collection of rebate data from 2009-2016 for all residential buildings in Cedar Falls, IA: 4000+ unique investments
2) Data anonymization and cleaning completed
3) Analysis of energy efficiency investments

PRELIMINARY RESULTS
Homeowners appear to find out about energy efficiency investments and rebates when large, essential equipment fails (e.g. HVAC) and need to make a large investment to fix; this leads to investments in other energy efficient technologies.

- 82% of homes invest in 1-2 energy efficient features
- Top 2% invest in 6+ energy efficient features
- Top 1% invest in 7+ energy efficient features

- Time to Invest
  After the first investment, the average time to make another investment is 1.75 years
  As more investments are made, the time between investments decreases
  After the 6th investment, all next investments are about 0.5 years apart

- Types of Energy Efficient Investments
  1st and/or 2nd investment is most commonly an HVAC system (47-60%)
  After the 4th investment, the lower costs LEDs are most common

CURRENT STATUS & WHAT’S NEXT?
- How to encourage more energy efficiency investments?
  - Study homeowners preferences: Why have homeowners made/not made energy efficient investments
  - Why is HVAC the first energy efficient investment?
  - What is the Willingness to Pay for efficient investments?
  - Characterization of homes/homeowners who have made investments
  - Realized vs. estimated savings; cost/benefit analysis