Results from a Pilot to Automate Energy Tradeoff Analysis

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mass save
Savings through energy efficiency

Introductions-Ekotrope Team

- Cy Kilbourn
- Vice President of Engineering
- 8 years experience developing energy analysis and HERS Rating software solutions

Introductions-ICF Team

Michael Berry

- Director
- Over 21+ Years in the EE Industry
- 13 years at ICF

Derek Briggs

- QA/QC Inspector
- 6+ Years in the EE industry
- 2+ years at ICF

What is this all about???

- ➔ Overview of a pilot program run in Massachusetts
- ➔ Details of the pilot implementation
- ➔ Summary of results
- ➔ What did we learn?
- ➔ What's next?

About Mass Save

Mass Save is an initiative sponsored by the Massachusetts Gas and Electric utilities and energy efficiency service providers, including **Berkshire Gas, Blackstone Gas, Cape Light Compact, Columbia Gas of Massachusetts, Eversource, Liberty Utilities, National Grid, and Unitil**. The sponsors of Mass Save work closely with the Massachusetts Department of Energy Resources to provide a wide range of services, incentives, trainings, and information promoting energy efficiency that help residents and businesses manage energy use and related costs. Visit http://www.masssave.com/ for more information.

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Gas Sponsors

Residential New Construction Program

- **Single point of contact** that covers projects with multiple fuel types, multiple utilities, and both commercial and residential meters
- All incentives are **performance-based**, with some exceptions
- A portion of utility bills paid in Massachusetts is allocated to a **fund for energy efficiency** programs in the state. This fund is then used to support Mass Save Programs
- Program requirements and performance targets align with **MA Base and Stretch Energy Code**
- ICF is the Program Administrators' lead vendor for the program

Overview & Requirements

- Participants include builders, developers, & homeowners
- Program approved HERS Rating companies
- Current Stretch Code requires a HERS 55
- Process includes: Hiring a HERS Rater, Plans Analysis/Energy Savings Assessments, Mid-Point Inspection, Final Inspection, Savings/Incentive Processing

"Yes, I'm a real Genie... but you're asking me to understand your client's requirements and even I can't do that!"

Incentive Structure

“Pay for Savings" Calculation:

*A * kWh + B * MMBtu + C * %Savings*

- Participant Incentive:
  - A = *$0.35/kWh*
  - B = *$35.00/MMBtu*
  - C = *$3,000* single family (1-4 units)
  - C = *$2,000* multifamily (5+ units)
  - No Cost LED lighting
  - **Average incentive = $1,500-$1,800**
  - Max incentive = $10,000
- Rater Incentive:
  - *$350/unit:* Single Family (1-4 units)
  - *$100/unit:* Multifamily (5+ units)

The View From The Field

- Participants often ask what upgrades will yield the most cost-effective incentives. They are often willing to make changes if options presented early enough in the process.
- To maximize incentive potential and energy savings currently takes trial and error to determine the best cost effective upgrades for the participant.
- Presenting options to relevant stakeholders can get lost in the fray.

Project Example: Cape Cod, MA

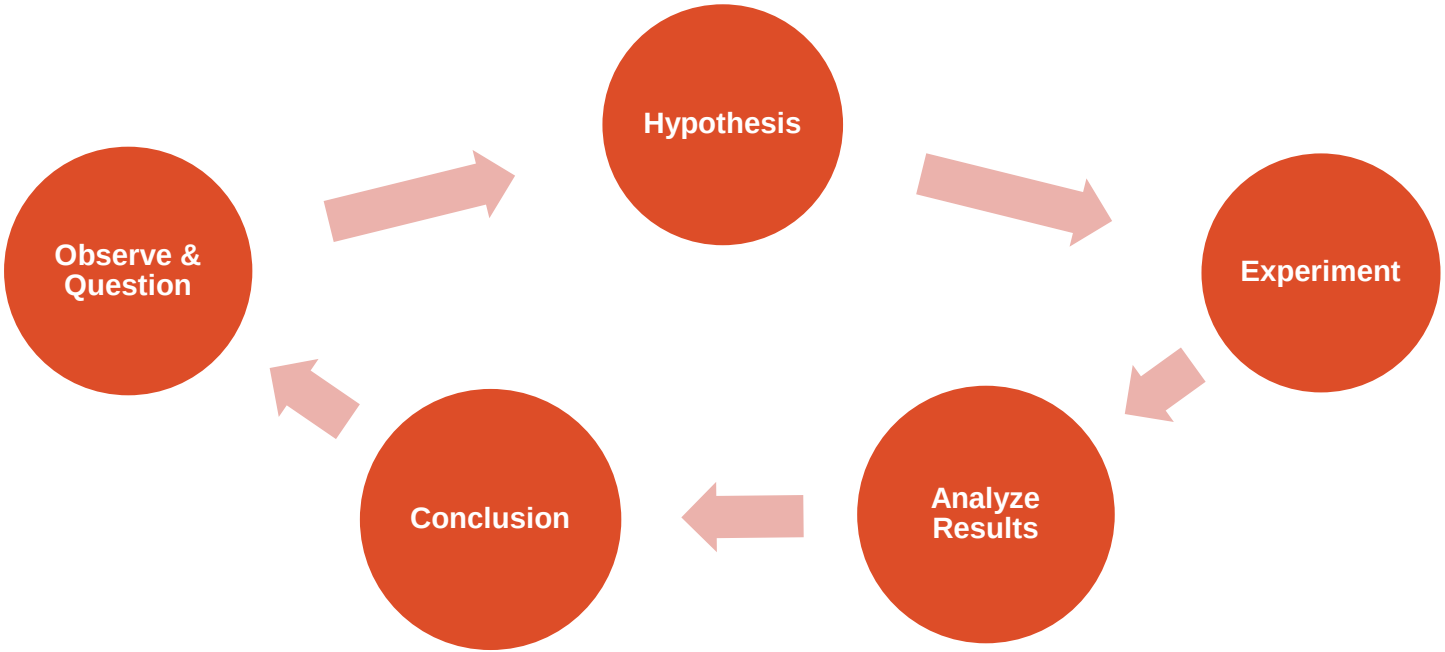
- 800 SF home built as a second residence.
- Participating rater was hired by owner to conduct duct leakage and infiltration testing.
- Original project scope was to build to code minimum.

Project Example: Cape Cod, MA

- Rater recommended that the owner participate in the New Construction program to take advantage of available incentives.
- Builder pushed back on all of the raters recommendations.
- Rater was able to advise the customer on the benefits of additional insulation, air and duct sealing, improved mechanicals, but was unable to make a compelling case to the builder that the recommendations would be cost effective.
- Project ultimately was built to code minimum and did not qualify for the program.
- An automated set of upgrades and corresponding incentives could have helped persuade the builder to make the changes.

Anatomy of a Pilot – Scientific Method

We must treat pilot programs as scientific experiments.



It starts with observation and questions…

We observed that raters may not have the tools available to easily analyze energy improvements and tradeoffs to identify the best design options.

Because of this, builders and raters may be leaving money on the table by not making the right energy decisions.

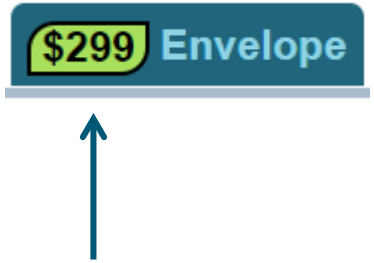
This is especially relevant in territories that have rebate programs.

Our Hypothesis

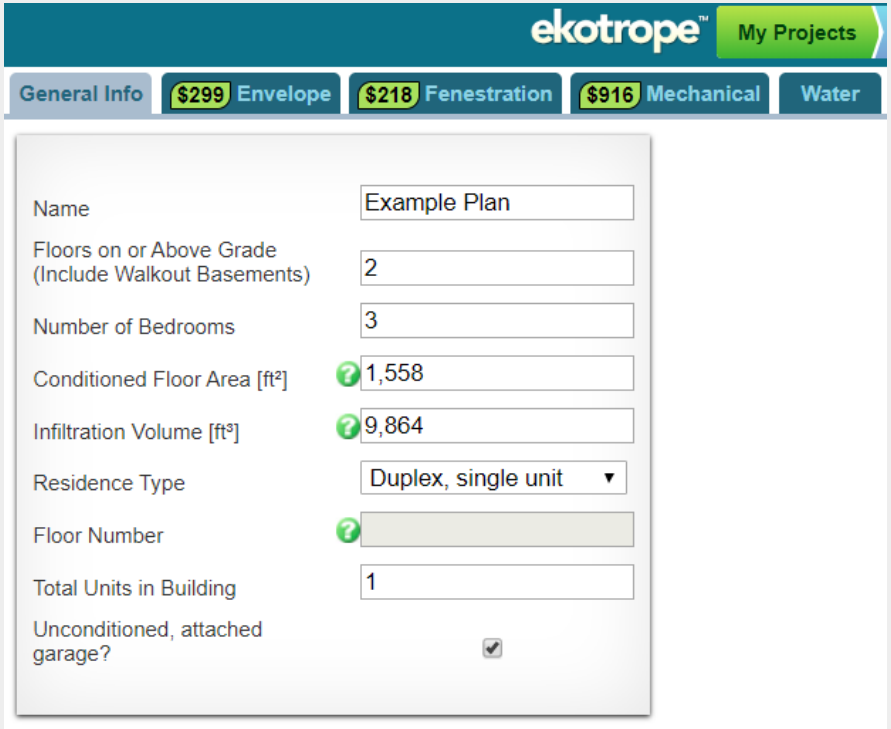
If we automatically show energy improvement suggestions to raters for each home, it will result in:

- Improved efficiency of homes (and higher rebates)
- Improved utility program participant satisfaction

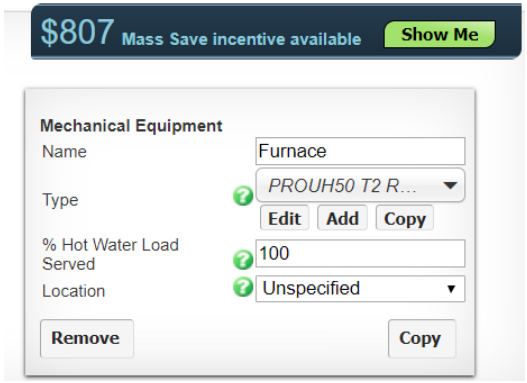
Embedded Savings Recommendations



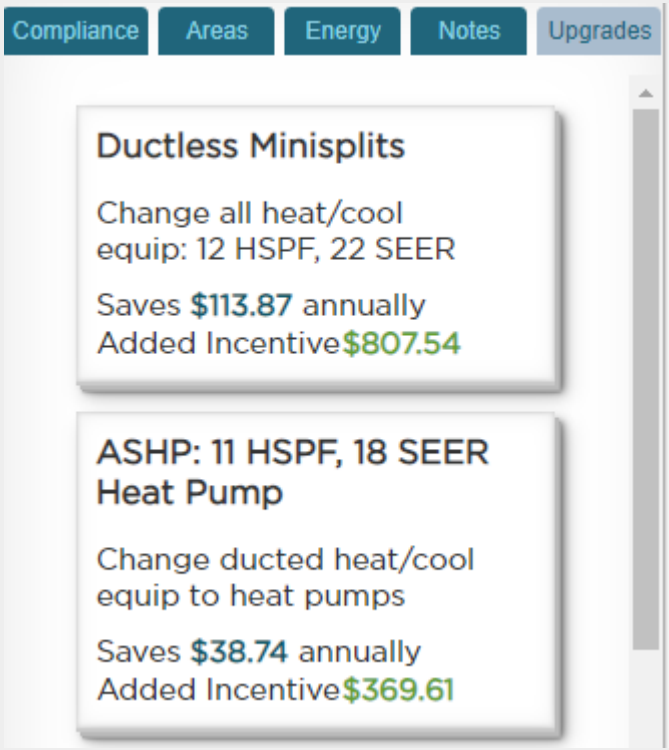
Rebate opportunities are automatically calculated and shown to the rater.



Embedded Savings Recommendations

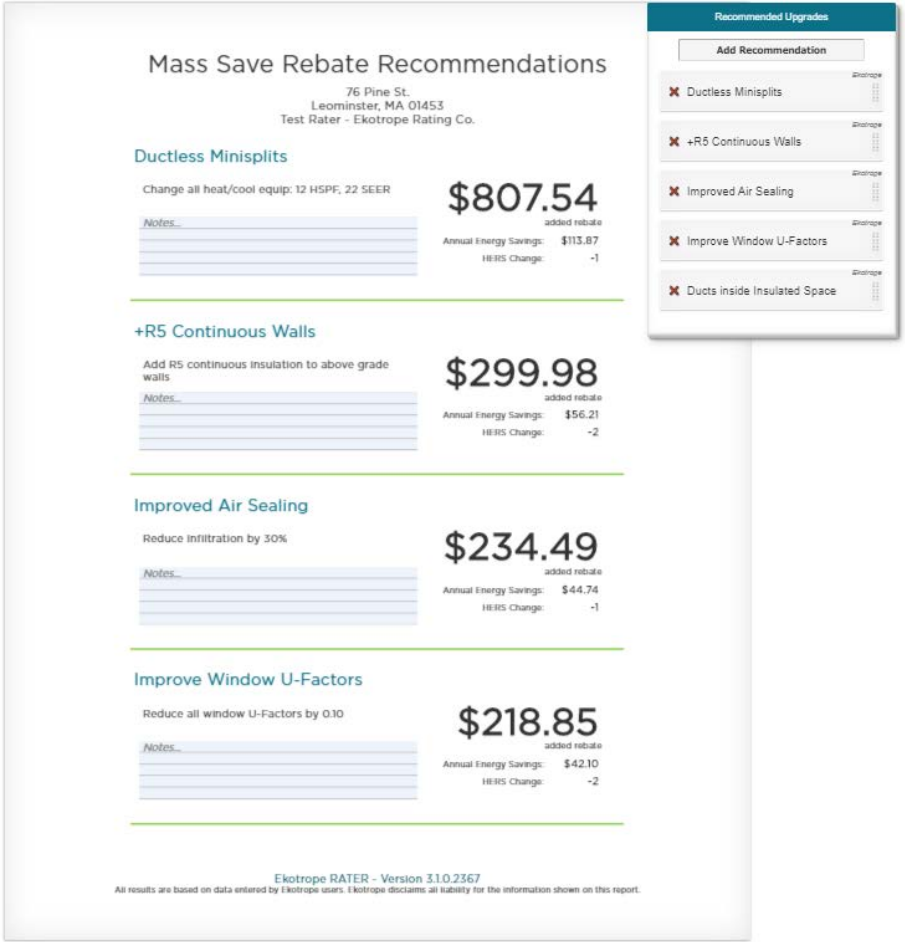


Details can be accessed quickly via a “Show Me” button



Customized Upgrade Recommendations Report

- ➔ Raters can print recommendations and send to builders.
- ➔ Fully supports custom recommendations and modifications.
- ➔ Recommendations can be added, removed, and re-ordered.



All Upgrades Run in Background

- ➔ Central 11 HSPF Heat Pump
- ➔ 96 AFUE Gas Furnace
- ➔ 96 AFUE Gas Boiler
- ➔ Ductless Minisplits
- ➔ Heat Pump Water Heater (3.4 EF)
- ➔ High Efficiency Tankless WH
- ➔ Bring ducts inside conditioned space
- ➔ Reduce duct leakage
- ➔ +R10 Attic Insulation
- ➔ +R5 Wall Insulation
- ➔ +R5 Slab Insulation
- ➔ Full R5 Slab Wrap
- ➔ Reduce Window U Factor 0.10
- ➔ Reduce Window U Factor 0.05
- ➔ R6 Doors
- ➔ 70% Recovery HRV
- ➔ 30% Infiltration Reduction
- ➔ +R10 Foundation Wall Insulation

Pilot Process

Pre-Pilot	Oct 1, 2019	Pilot	Jan 1, 2020	
Program as usual, no changes		All program participants have access to automated recommendations engine		Results analysis period

Poll #1

Show of hands…

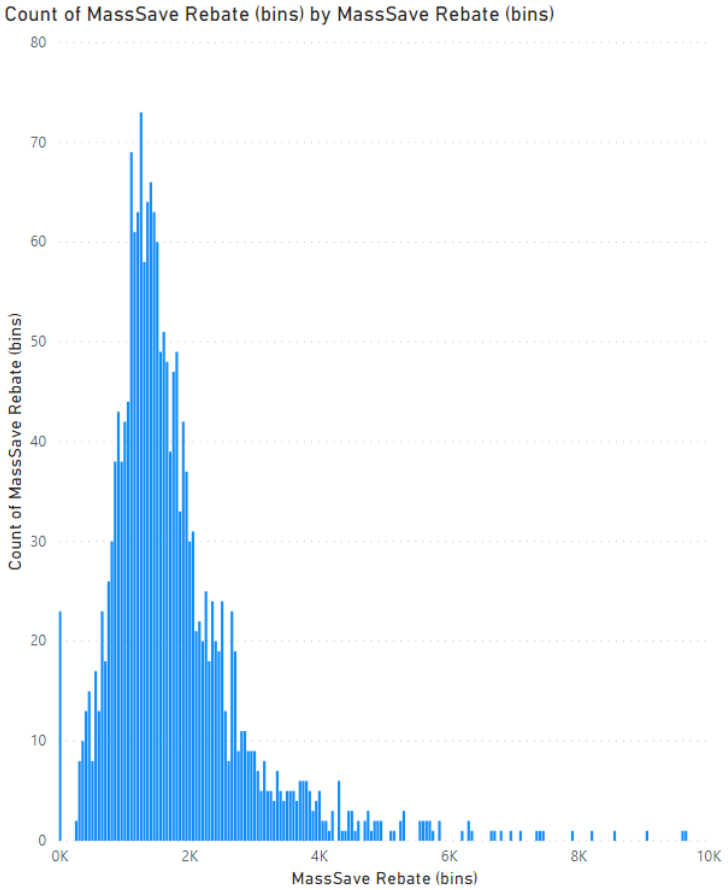
How many think this had a positive impact on **savings**?

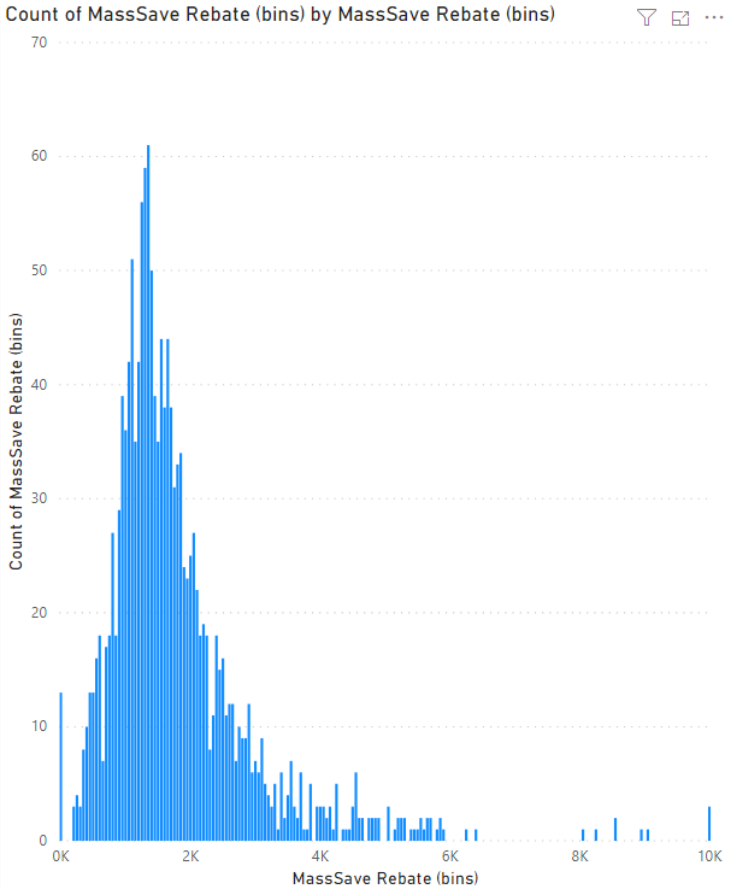
Poll #2

Show of hands…

How many think this had a positive impact on **participant experience**?

Ensure Normal Distribution of Data:

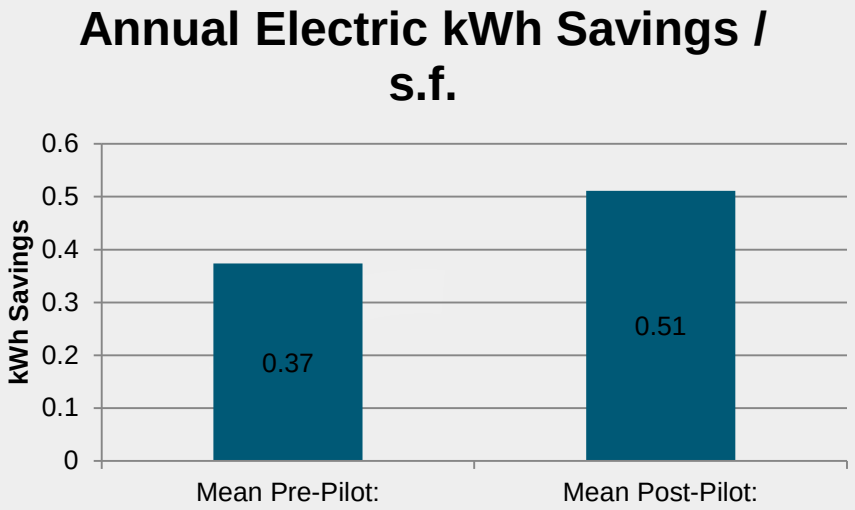


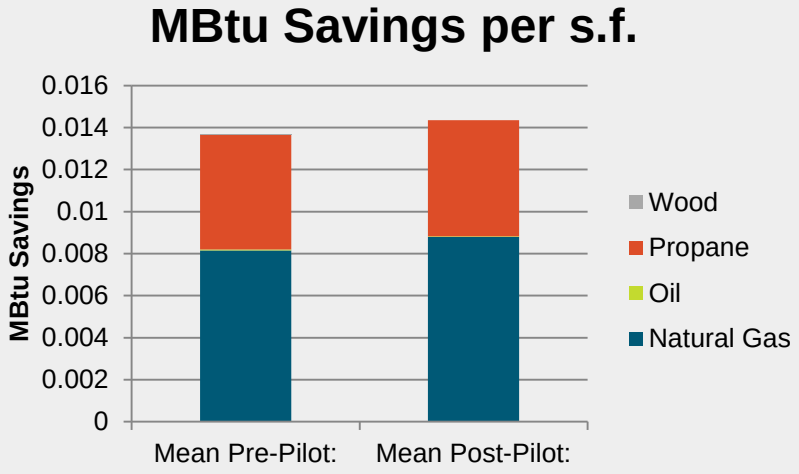


Savings Results

During the pilot period…

- Average total rebate per home increased by 1.2%
- Average kWh savings per s.f. increased by 37%
- Average fuel savings per s.f. increased by 4.8%

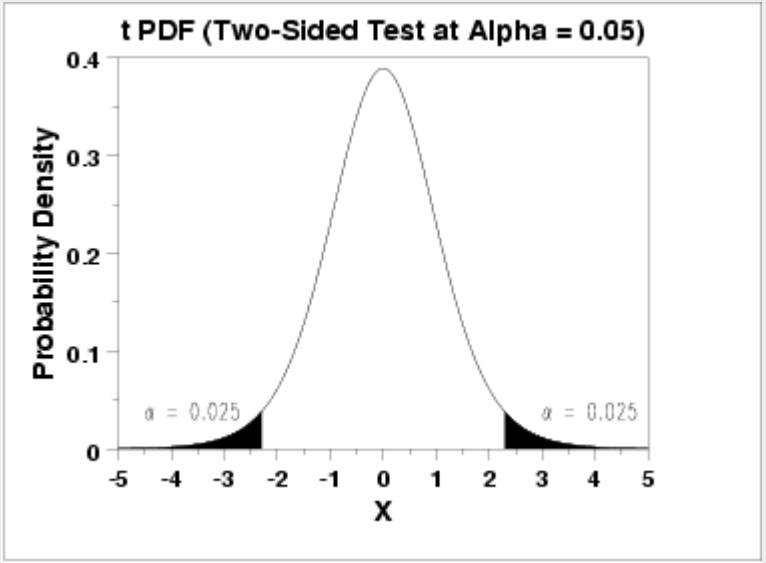




Are the Results Significant?

If we assume the pre- and post-pilot homes processed are a representative, random sample of the entire set of pre- and post- pilot submissions (past and future), then…

- We cannot be at all confident that there is an increase in average rebate in the post-pilot population.
- We can be 99.9% confident that there is an increase in kWh savings / s.f. in the post-pilot population.*
- We can be 91.5% confident that there is an increase in Mbtu savings / s.f. in the post-pilot population.*



	P Value (< 0.05 is significant)
Average Rebate Savings	0.5683
Average kWh / s.f.	0.0013
Average Mbtu / s.f.	0.0845

This does not necessarily mean it can be attributed to the introduction of upgrade recommendations.

Participant Experience Surveys

Pre-Pilot Survey

Q1: "How satisfied are you overall as a participant in the Mass Save New Homes offering?"

Q2: "How well does your rating software enable you to find and suggest energy upgrade measures to your builders?"

Q3: "How strongly do you agree that software innovation is improving the Mass Save New Homes offering?"

Post-Pilot Survey

Also includes Q1 – Q3

Q4: "How strongly do you agree that the addition of suggested savings opportunities embedded in the Ekotrope modeling platform has improved your experience with the Mass Save program?"

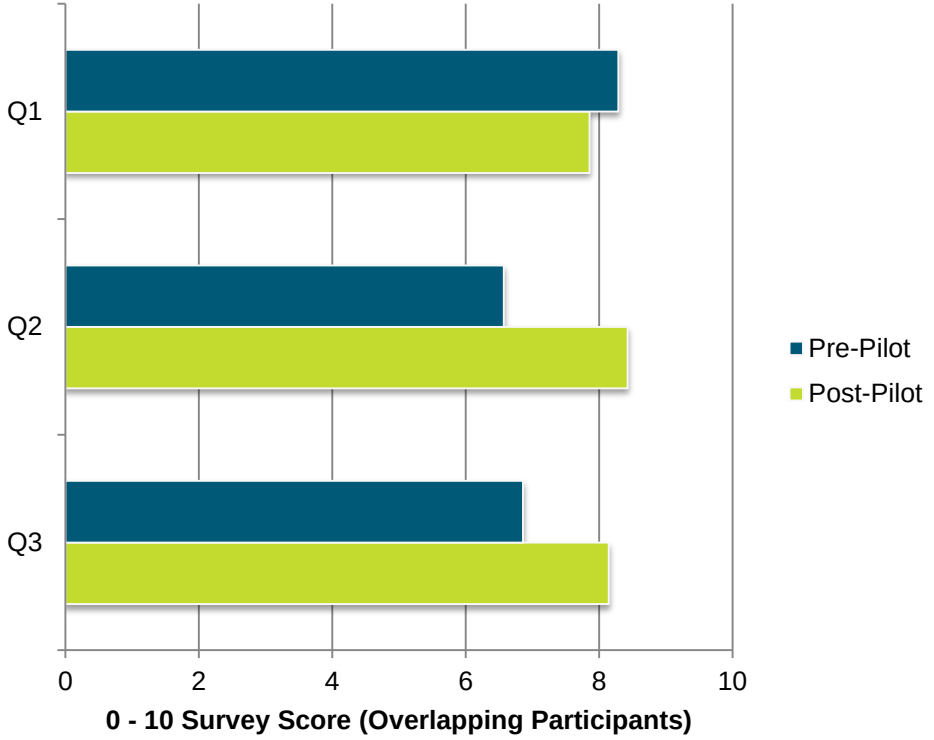
Q5: "How strongly do you agree that the addition of suggested savings opportunities embedded in the Ekotrope modeling platform (see images above) has improved the efficiency of the homes you have submitted to the Mass Save program?"

Pre / Post Pilot Results (Q1– Q3)

Q1: "How satisfied are you overall as a participant in the Mass Save New Homes offering?"

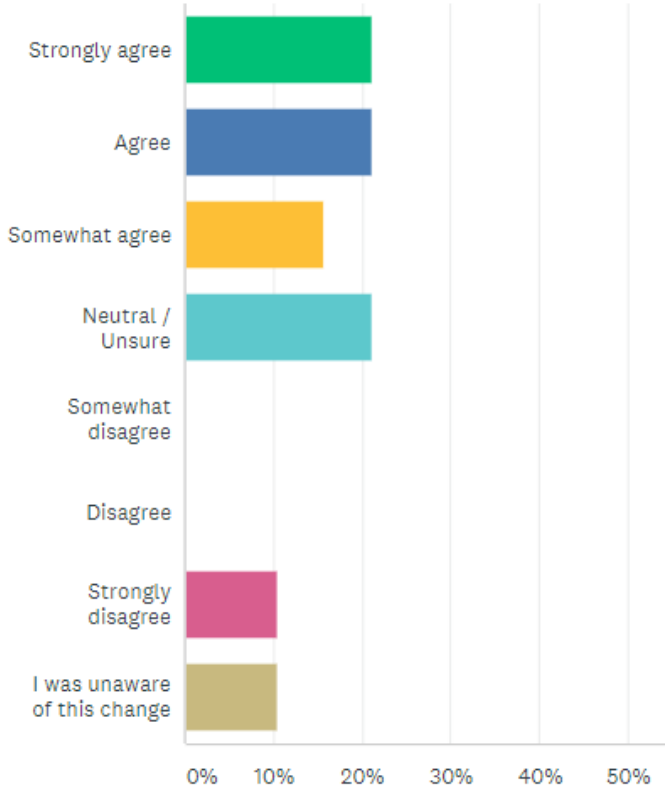
Q2: "How well does your rating software enable you to find and suggest energy upgrade measures to your builders?"

Q3: "How strongly do you agree that software innovation is improving the Mass Save New Homes offering?"



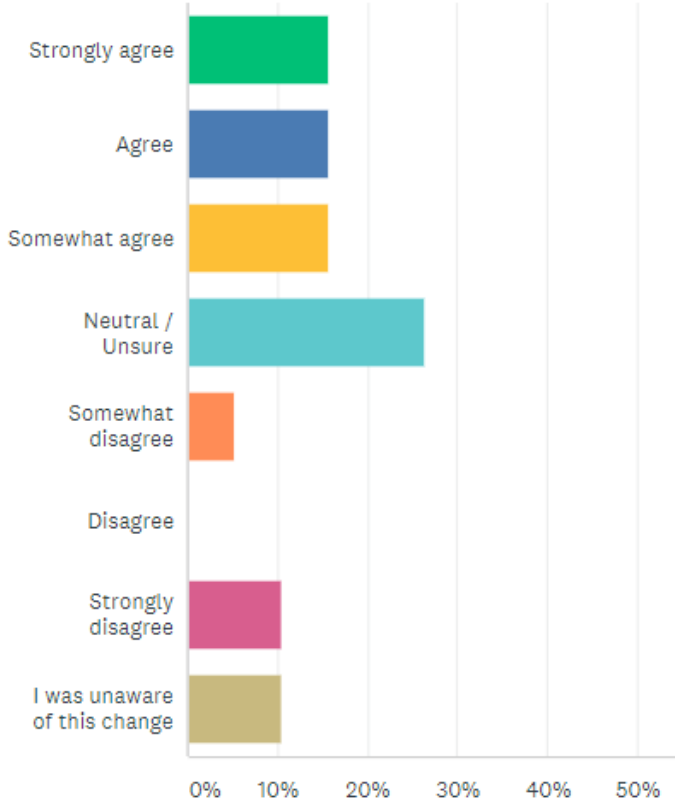
Post Pilot Results (Q4)

Q4: "How strongly do you agree that the addition of suggested savings opportunities embedded in the Ekotrope modeling platform has improved your experience with the Mass Save program?"



Post Pilot Results (Q5)

Q4: "How strongly do you agree that the addition of suggested savings opportunities embedded in the Ekotrope modeling platform has improved the efficiency of the homes you have submitted to the Mass Save program?"



Conclusions

Preliminary results suggest that by using technology to automatically suggest upgrade measures, we can…

- ➔ Improve electric and fuel savings / s.f. in utility programs.
- ➔ Improve the ability of raters to find and suggest upgrade measures for their builders.
- ➔ Improve the efficiency of new home construction.
- ➔ Improve participant experience in rebate programs.

Next Steps

This is early data and a small sample size. Our next steps are:

➔ Continue to run this pilot in Massachusetts to collect more data.

➔ Expand the concept to other utility programs to validate results.

Discussion

For Raters: Would this help you provide upgrade recommendations to builders and/or design more efficient homes?

For Utilities / Implementers: Are these savings meaningful? What is the value?

Are there other things we should measure?

Thank you! Any questions?