



# Connecticut HES / HES-IE Single Family Impact and Process Evaluation (R1983)

*Final Presentation*

**Presenters:**

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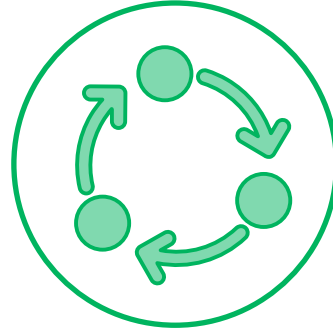
July 13, 2023





## Impact Evaluation of Every HES & HES-IE Measure and Fuel Type Combination

- Billing analysis
- Building simulation
- Engineering algorithms



## Comprehensive Process Evaluation

- Stakeholder interviews (n=30)
- Participant surveys (n=1,208)
- Program materials review
- Program benchmarking



## Customer Profiling Effort (entire residential portfolio)



**Present and discuss every study finding and recommendation**

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**Note:** *For cross-referencing purposes, we've included the relevant table or figure number from the final report throughout the presentation.*

AIR SEALING AND INSULATION SAVINGS IN NATURAL GAS-HEATED HOMES ARE MUCH LOWER THAN THE PREVIOUS EVALUATION AND EX ANTE VALUES, BUT GENERALLY IN LINE WITH REGIONAL BENCHMARKS.

# Key Finding #1: Why start with air sealing and insulation?

In 2019, these two measures represented more than 80% of both programs' expected lifetime savings across all fuel types.

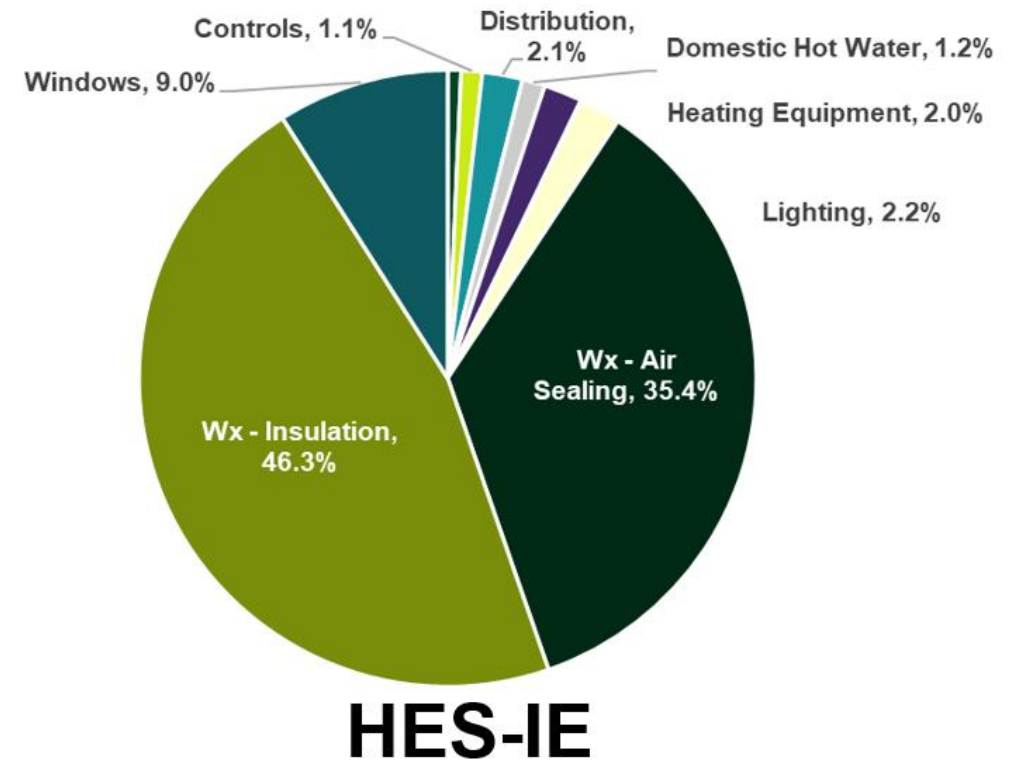
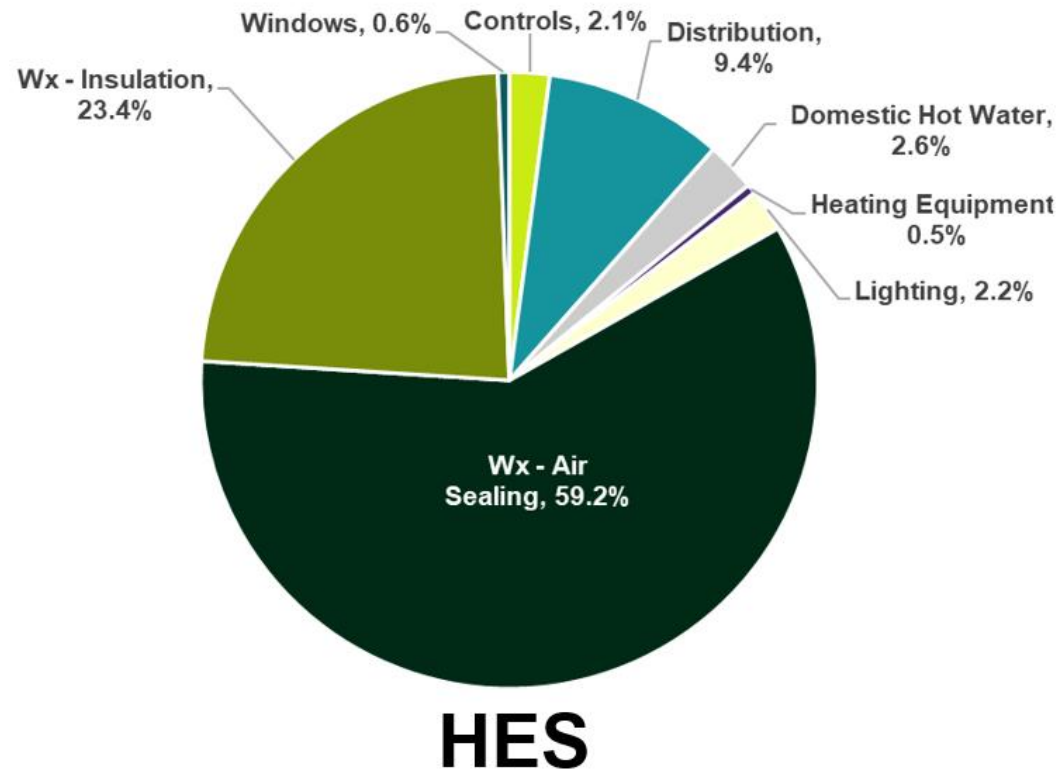


Figure 2

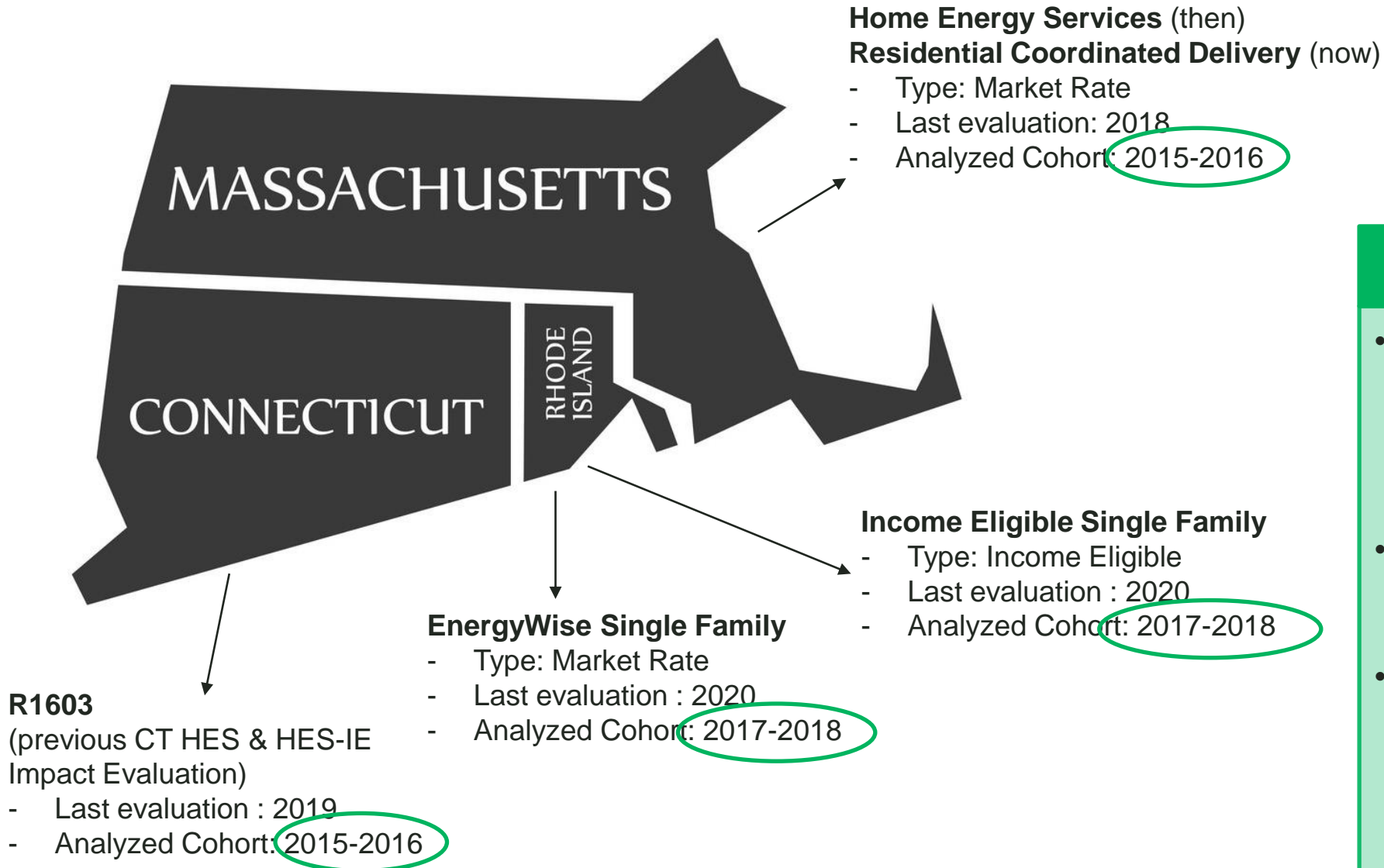
# Key Finding #1: Results

Based on billing analysis of 2019 natural gas-heated participants; savings are average CCF/year reduction per participant

Program	Air Sealing				Insulation			
	Previous Eval	Ex Ante*	Ex Post	Realization Rate	Previous Eval	Ex Ante*	Ex Post	Realization Rate
HES	64	102	17	17%	154	119	60	51%
HES-IE	59	106	11	10%	158	211	97	46%

*\*Reported in program tracking data*

# Key Finding #1: Key Regional Program Benchmarks



## Several Notable Differences:

- **Air Sealing.** MA and RI programs perform air sealing during insulation installation visit (not the assessment like in CT)
- **Incentives.** CT historically aimed to cover ~50% of upfront cost, MA covers 75%)
- **Eligibility Requirements.** HES requires an existing R-value in attics of R-19 or less, while MA and RI will insulate any attic under R-49



# Key Finding #1: Benchmarking - Most Recent Eval Results

Evaluated savings for insulation are similar to RI and MA, but less for air sealing. All were considerably less than the previous CT evaluation (R1603).

Program Type	Program	Reference	Air Sealing	Insulation
Market Rate	<b>HES (CT, 2019)</b>	<b>Current CT evaluation (R1983)</b>	<b>17</b>	<b>60</b>
	HES (CT, 2015-16)	Previous CT evaluation (R1603)	64	154
	EWSF (RI, 2017-18)	Regional Benchmark	33	60
	HES/RCD (MA, 2015-16)	Regional Benchmark	31	98
Income Eligible	<b>HES-IE (CT, 2019)</b>	<b>Current CT evaluation (R1983)</b>	<b>11</b>	<b>97</b>
	HES-IE (CT, 2015-16)	Previous CT evaluation (R1603)	59	158
	IESF (RI, 2015-16)	Regional Benchmark	N/A	87



# Key Finding #1: Benchmarking - Longer-Term Savings Trends

There is a downward trend in evaluated savings over time for both air sealing and insulation.

More soon: Both MA and RI are conducting impact evaluations in 2023 (on 2021 cohorts)

This tell us: Lower savings than the prior evaluation is common

Higher R1603 weatherization savings (relative to MA and RI) may have been overstated and meant a steeper decline resulting from R1983 was possible

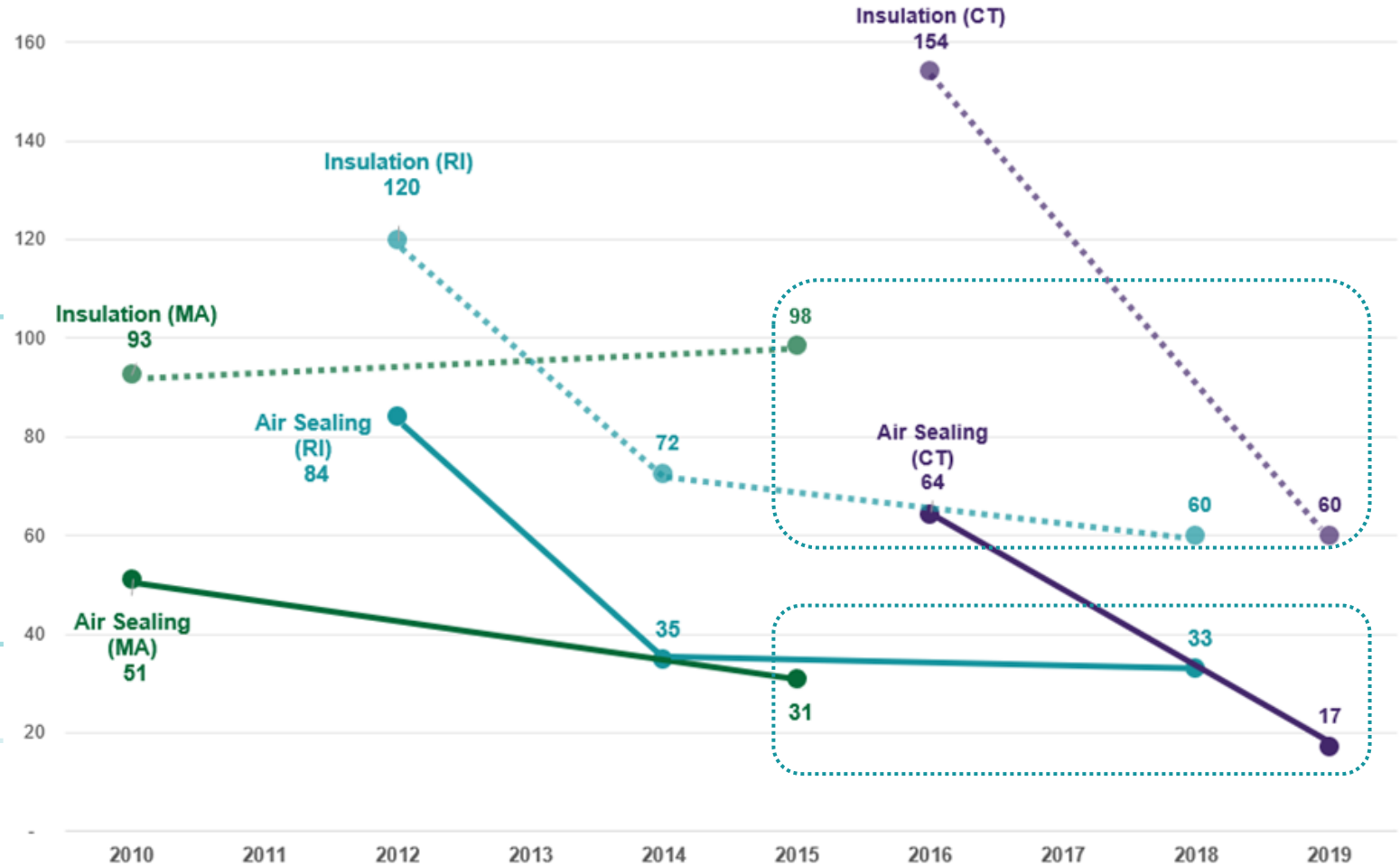


Figure 4

# Key Finding #1: Multiple Related Drivers

Less pre-program consumption (CCF/year) over time for subsequent participating cohorts

- Correlated with smaller homes and increasing heating system efficiencies
- Less consumption means less opportunity for savings
- Common for maturing programs

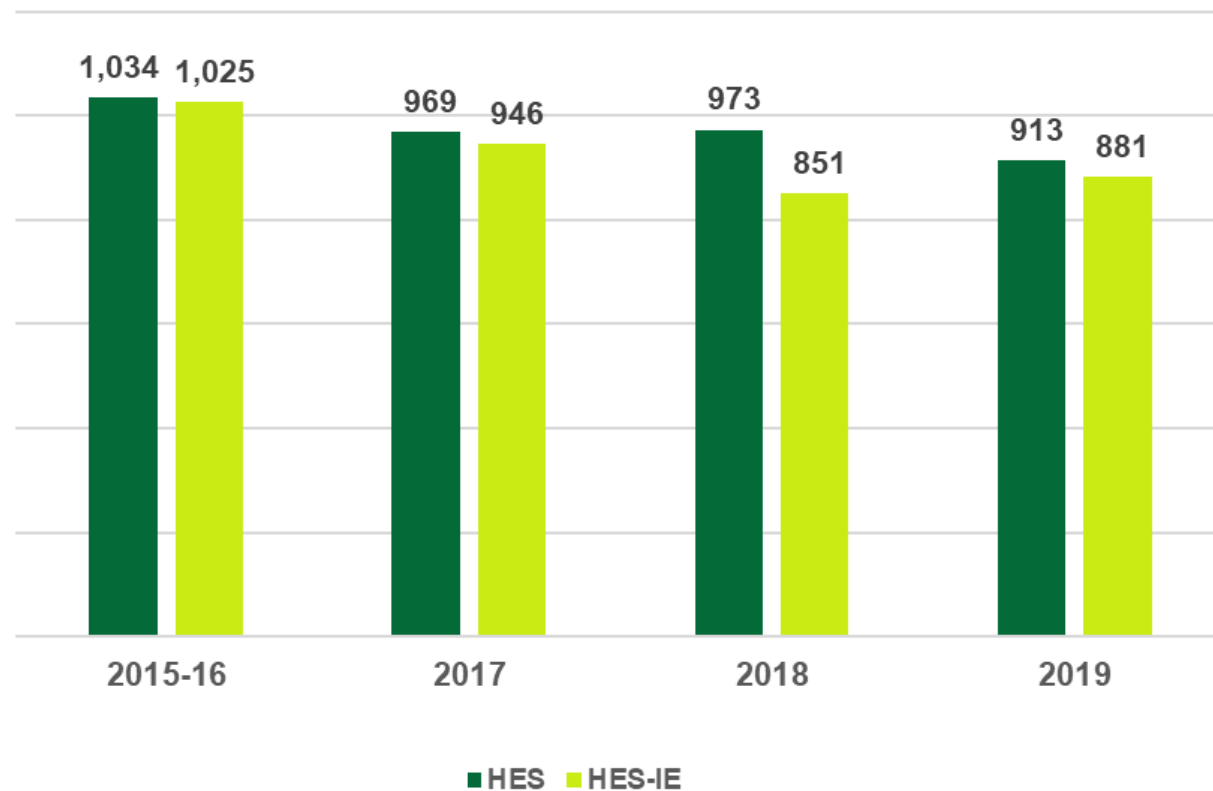


Figure 5

It's a lot to air seal while performing other assessment functions.

- According to vendors, most spend between 2-4 hours at each home and typically do two homes per day.
- That includes surveying, direct install measures, air sealing, the “kitchen table” wrap-up and, for some customers, the DOE Energy Score. That's a lot – even for two person teams.
- It's less than MA RCD average (6 hours of air sealing), which occurs during separate visit.
- Difficult to directly compare across programs, but results suggest the CT air sealing delivery model is less comprehensive.

# Key Finding #1: What about Delivered Fuel Participants?

We've been talking about natural gas participants and results, but important to remember that delivered fuels - **heating oil and propane** - represent the majority of HES expected lifetime savings. (For HES-IE, it's gas).

**However, evaluators don't have access to delivered fuel consumption data.**

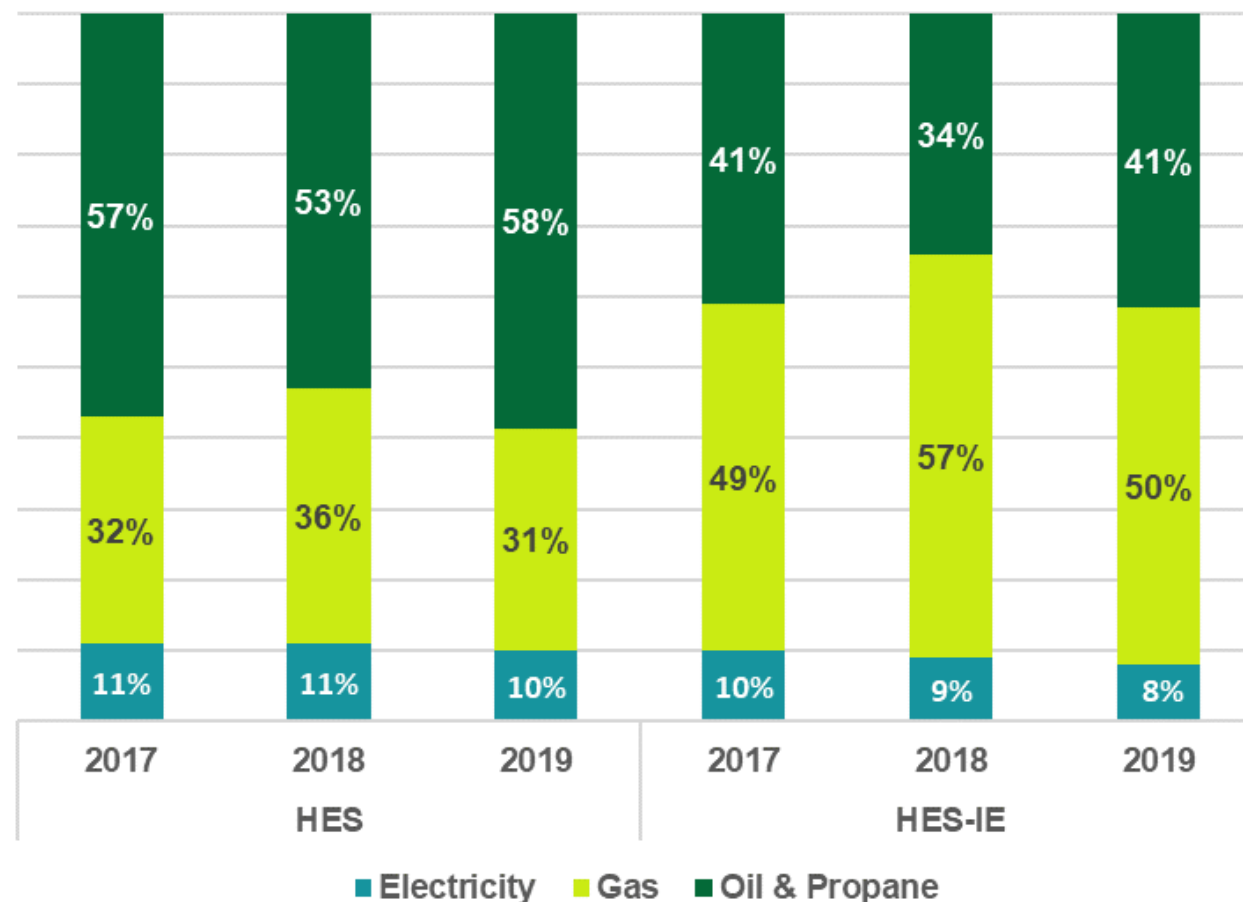
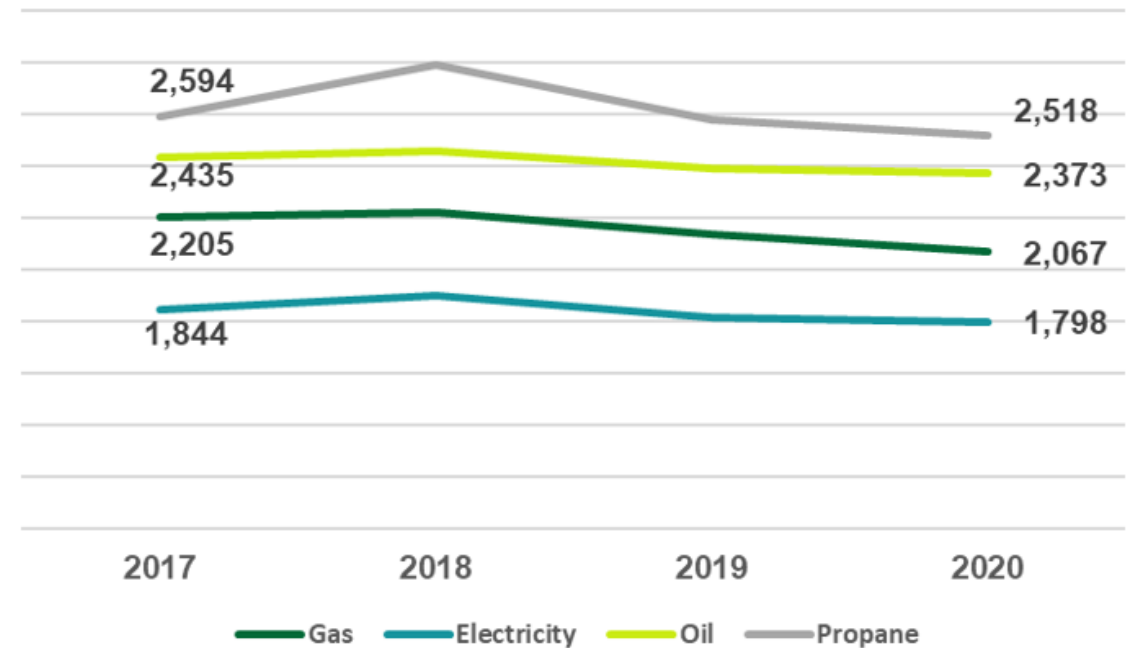


Figure 3

# Key Finding #1: Delivered Fuels

The study made engineering adjustments to the natural gas billing results to apply them to delivered fuels – most notably accounting for differences in home size across fuel types.

The savings and realization rates for insulated delivered fuel customers were solid, especially for HES-IE, while air sealing remained low.



Measure Group	Measure	Oil				Propane			
		HES		HES-IE		HES		HES-IE	
		gal	RR	gal	RR	gal	RR	gal	RR
Weatherization	Air Sealing Infiltration Reduction (Blower Door Test)	14	18%	9.5	11%	23	22%	15	16%
	Insulation – All	65	67%	91	101%	105	69%	147	102%

Table 4 & Figure 6

1A. Refine the HES incentive structure to encourage more comprehensive weatherization.

1B. Increase targeting of homes with greater savings potential (i.e., energy intensity).

1C. Consider an air sealing field assessment to assess work quality and missed opportunities

**HES PARTICIPANTS INSTALL INSULATION  
LESS OFTEN THAN PARTICIPANTS IN  
SIMILAR REGIONAL PROGRAMS**



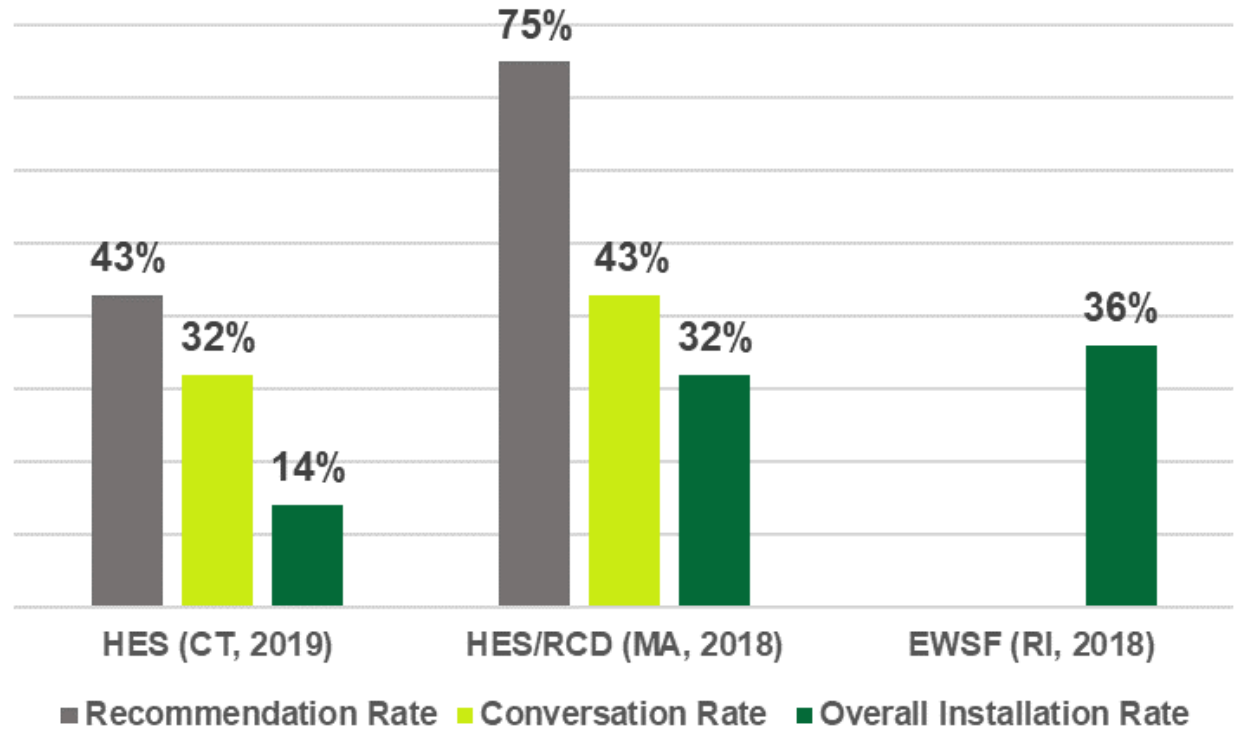
**Goal:** *Identify efficiency opportunities and, through incentives and education, to get customers to act on those opportunities.*

- Obvious, but essential when considering the effectiveness of an assessment-based program
- For HES, which requires a customer co-pay, this primarily means getting participant to insulate their homes
- Multiple Metrics:
  - Recommendation rate.  $\text{Insulation Recommendations} / \text{Total Assessments}$
  - Conversion rate.  $\text{Insulation Installations} / \text{Assessments with Insulation Recommendations}$
  - Installation rate.  $\text{Insulation Installations} / \text{Total Assessments}$

# Key Finding #2: HES Installation Metrics

## HES trails well behind neighboring states in insulation installation

The percentage of 2019 HES participants that install insulation following their assessment is **less than half** that of programs in MA and RI.



## Design Differences

**Lower Incentives.** CT has historically aimed to cover ~50% of upfront cost, which is less than MA's historical target (75%)

**Stricter Eligibility Requirements.** HES requires an existing R-value in attics of R-19 or less, while MA and RI will insulate any attic under R-49

**Air Sealing During the Assessment Approach.** It's possible HES participants think they're "done" after receiving air sealing during their assessment. Also, vendors fuller plate during assessment limits time to engage with customer

## "Kitchen Table" Wrap-Ups

The survey found modest recall of "kitchen table" wrap-up discussion. ~1/3 of HES participants did not recall their vendor discussing recommendations with them at the end of their assessment, which is an influential moment in decision-making process.

## Recommendations for Key Finding #2

2A. Revisit HES' current existing conditions requirements to quality for insulation.

2B. Directly incentivize HES vendors based on their insulation conversion rate, not just air sealing completions.

2C. Provide dedicated sales training

**75% off insulation incentive example**

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Project cost: \$3,500

Incentive: \$2,625

Customer payment: \$875

MassSave.com

**Average Initial Cost**

-The average initial cost varies from home to home. This is based on the square footage and insulation needs.

EnergizeCT.com

2D. Simplify & sharpen customer-facing incentive messaging

2E. Develop a program or offer elevated incentives targeting moderate-income households and/or rental properties

THE RESULTS OF THIS EVALUATION REVEAL AN IMPLICIT TRADE-OFF AND CENTRAL QUESTION INHERENT IN CONNECTICUT'S CURRENT DELIVERY MODEL: WHAT'S BETTER - LESS SAVINGS AT MORE HOMES OR MORE SAVINGS AT FEWER HOMES?

# Key Finding #3: Comparing Delivery Models

In CT, blower-door guided air sealing is implemented in nearly every participating home. In MA and RI, a much lower percentage of participants receive air sealing – just those that opt to install insulation.

To fully assess both delivery models, it is important to assess the **average savings** and **incidence with which air sealing and insulation occur** for each program.

This perspective recognizes that, while CT model produces a lower average savings per air sealed customer, it does result in a much larger percentage of participants receiving air sealing.



# Key Finding #3: Comparing Delivery Models

HES' lower average insulation savings and lower installation rate mean the average weatherization savings per assessed home in HES is lower than both MA and RI, despite air sealing a greater portion of participants.

	Connecticut (HES)		Massachusetts (HES/RCD)		Rhode Island (EWSF)	
	% of Participants	Average Savings	% of Participants	Average Savings	% of Participants	Average Savings
Received only air sealing	76%	17	0%	0	0%	0
Received air sealing & insulation	14%	77	32%	125	36%	93
Did not receive air sealing or insulation	10%	0	68%	0	68%	0
<b>Overall</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>40</b>	<b>100%</b>	<b>33</b>

However, improvements in average savings and/or installation rates in CT could change this comparison from a savings per assessed home perspective – while achieving at least some savings (from air sealing) in more homes.

3A. The Companies should carefully consider how to modify or whether to continue the current delivery model.

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While the evaluation offers information for assessing optimal program delivery, this study cannot offer a definitive recommendation as the question is not purely an evaluation one.

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Such a decision requires balancing critical non-evaluation factors such as statewide policies (including definitions of “weatherized”), energy savings goals, and equity that lay outside the domain of this study.

UNLIKE AIR SEALING AND INSULATION, THE STUDY GENERALLY FOUND HIGH GROSS SAVINGS AND NTG RESULTS FOR MOST OTHER MEASURES.

# Key Finding #4: Other Measures

## Lighting



- Identical savings to previous evaluation
- Realization rate of 91% for HES-IE
- However, no longer part of program

## Duct Sealing



- Also evaluated via billing analysis
- 8 therms/ participant (that received the measure, which was 38% of HES participants)
- Low realization rate like air sealing and insulation

## Smart Thermostats



- Recommending updated heating load input value (from this study) to replace current source (from 2012)

## Others



- Many other measures had gross realization rate of 100% or close
- Limited recommendations re: current PSD algorithm and input parameters

# Key Finding #4: Overall Metrics

**Gross Savings.** The fuel-specific and overall program gross realization rates (GRR) are largely driven by the air sealing and insulation values given their role in both programs.

Program	Electricity		Natural Gas		Delivered Fuels		Overall	
	% of Lifetime Savings	GRR	% of Lifetime Savings	GRR	% of Lifetime Savings	GRR	% of Lifetime Savings	GRR
HES	10.3%	39.5%	31.3%	29.0%	58.3%	34.0%	100%	33.0%
HES-IE	8.3%	82.3%	50.3%	33.5%	41.3%	66.2%	100%	51.1%

**Net-to-Gross.** Relevant only for HES, the study found an overall NTG of 84%. The values does not include lighting given the program’s phase-out of the measure.

Ratios and Ratio	HES
Weighted free-ridership rate	23%
Weighted spillover rate	7%
Net-to-gross ratio	84%

4A. Apply the recommended PSD changes documented in Appendix F as part of the next PSD update



FINANCIAL AND LOGISTICAL BARRIERS  
IMPEDE THE STATEWIDE WEATHERIZATION  
GOALS.



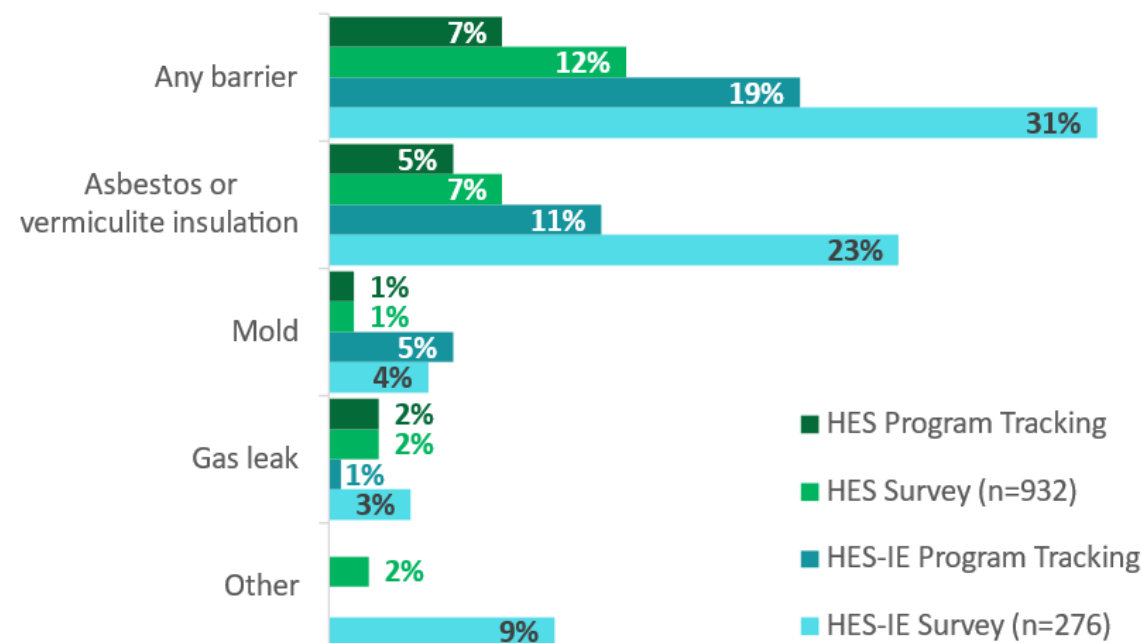
# Key Finding #5: Health and Safety Barriers

At least 7% of HES and 19% of HES-IE participants from 2017 to 2020 had a health and safety barrier that affected their assessment.

Cost is a significant barrier to both remediating health and safety barriers and installing additional measures following the assessment.

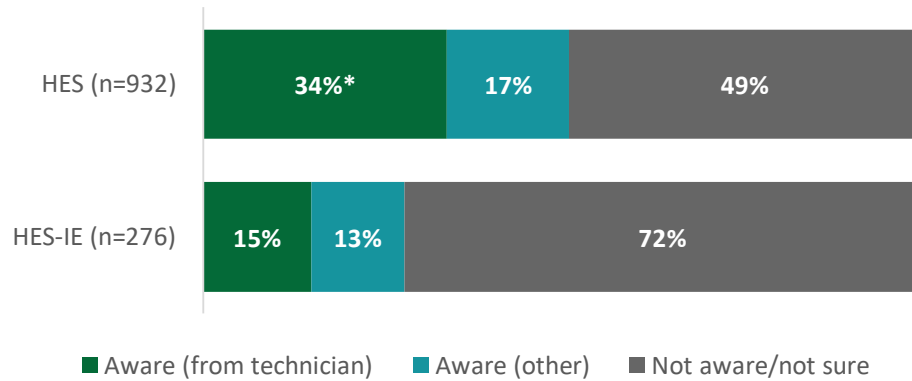
Demand for remediation assistance likely exceeds available funding.

### Incidence of Health and Safety Barriers in HES/HES-IE



# Key Finding #5: Other Barriers

## Awareness of Financing Options



*“They must first define weatherization. Then, delegate a specific budget for this (the CL&M funds alone can’t pay for this work)... A “goal” is not a mandate, so the 80% by 2030 weatherization goal exists with no arsenal, nothing to back it up. There are no laws, statutes, or DEEP mandates with a strategy/plan to bring this goal to fruition.” - Vendor*

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Cost was a leading deterrent for rebated measure installation and awareness of financing options was limited.

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Vendors and community stakeholders doubted that the state of Connecticut will meet its goal of weatherizing 80% of all residential units in 2030 without significant changes in program funding, incentives, and workforce development.

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Qualified technicians are in demand but scheduling on-the-job training can be difficult.

# Recommendations for Key Finding #5

- 5A. Expand the Statewide Weatherization Barriers program to serve the needs of low- and moderate-income customers.
- 5B. Work with existing vendors and contractors to increase training opportunities, recruit new technicians, and conduct outreach to technical schools.

CERTAIN CUSTOMER SEGMENTS FACE  
ADDITIONAL BARRIERS TO PARTICIPATION  
IN HES AND HES-IE.

# Key Finding #6: Barriers to Participation

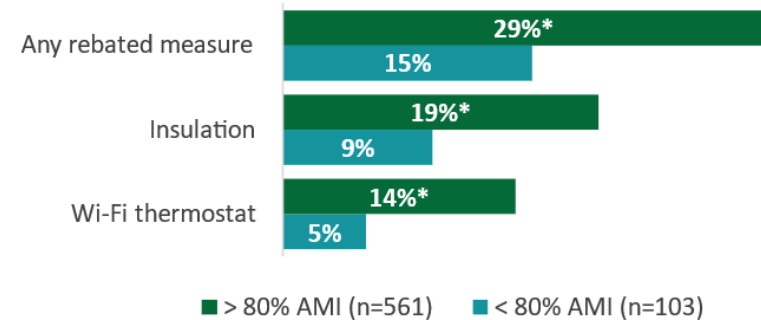
Customer segments underserved by the program included: low- and moderate-income customers, renters, rural customers, customers with limited English proficiency, elderly customers, and immigrant customers.

Program participants are more highly educated and younger than the general population.

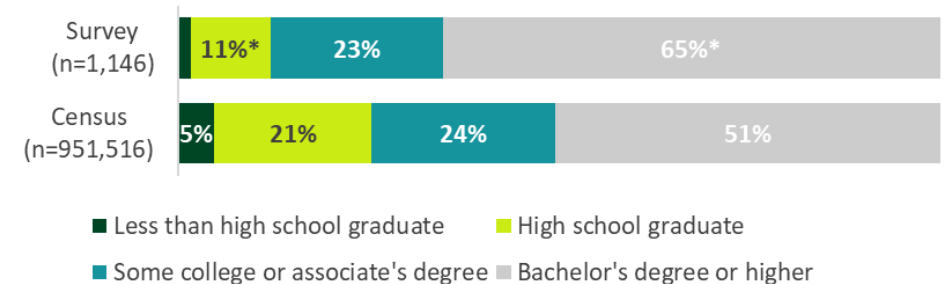
Renters face barriers to participation that disproportionately affect HES-IE customers.

Barriers to participation: difficulty affording health and safety remediation, installing additional measures, accessing program information, and scheduling assessments.

## Rebated Measures Installation by Income (HES)

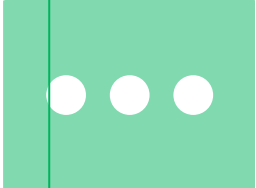


## Highest Educational Attainment of Owner-Occupied Households

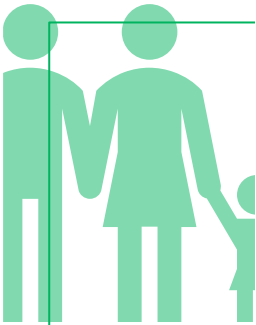


\*Significantly different than the comparison group at the 90% confidence level.

# Key Finding #6: Outreach and Marketing



Program marketing and word-of-mouth referrals are the primary sources of program awareness among current participants.



Community stakeholders suggested the Companies shift their outreach focus to community outreach efforts as opposed to Company marketing efforts.

Top Sources of Program Awareness

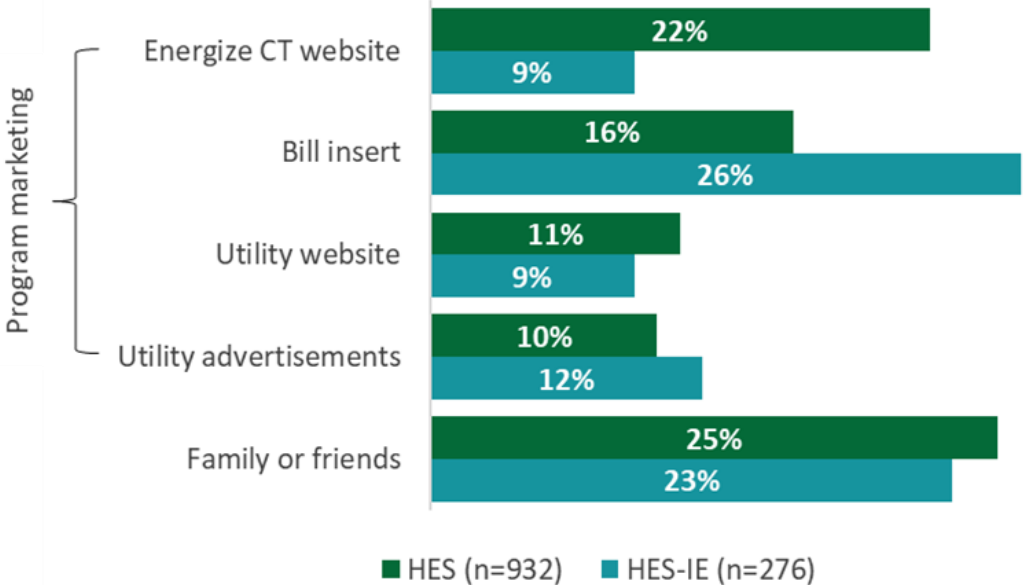


Figure 20

# Recommendations for Key Finding #6

6A: Remove barriers to participation for customers with limited English proficiency by providing vendors with access to a language line and use of other language technologies.

6B: Expand eligibility for HES-IE or consider targeted program offerings for moderate income customers.

6C: Offer assessments on evenings or weekends to accommodate customers who are unable to take off work during the weekday.

6D: Divert resources from traditional marketing campaigns community outreach efforts. Work with local institutions and organizations to spread awareness about the program in communities.

OVERALL SATISFACTION AMONG VENDORS AND HES PARTICIPANTS IS HIGH, WITH ROOM TO IMPROVE PROGRAM COMMUNICATION AND MESSAGING, PARTICULARLY FOR HES-IE PARTICIPANTS.



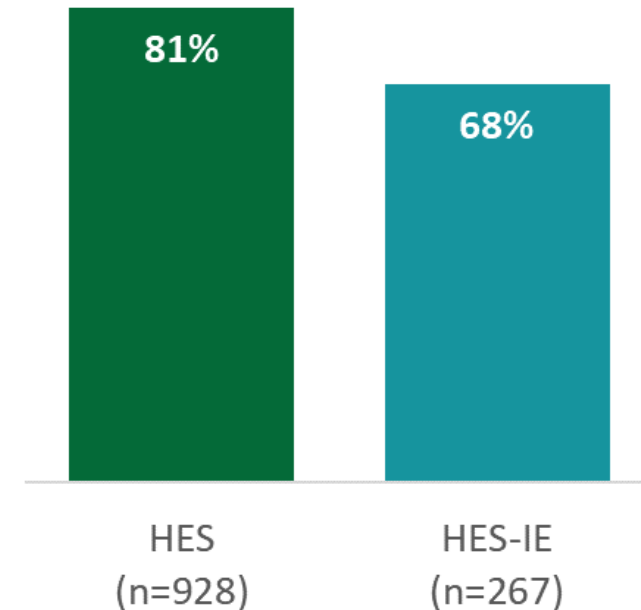
# Key Finding #7: Vendor and Participant Satisfaction

Vendors expressed overall satisfaction with the program and their role promoting energy-efficiency and weatherization services to customers

HES participants report higher overall satisfaction with the program (81%) than HES-IE participants (68%)

- HES-IE participants reported higher levels of dissatisfaction with :
  - The professionalism and service provided by technicians (13% vs 4% HES participants)
  - The energy savings from their assessment (20% vs 11% of HES participants)

**% of Participants Satisfied or Very Satisfied with Overall Experience**



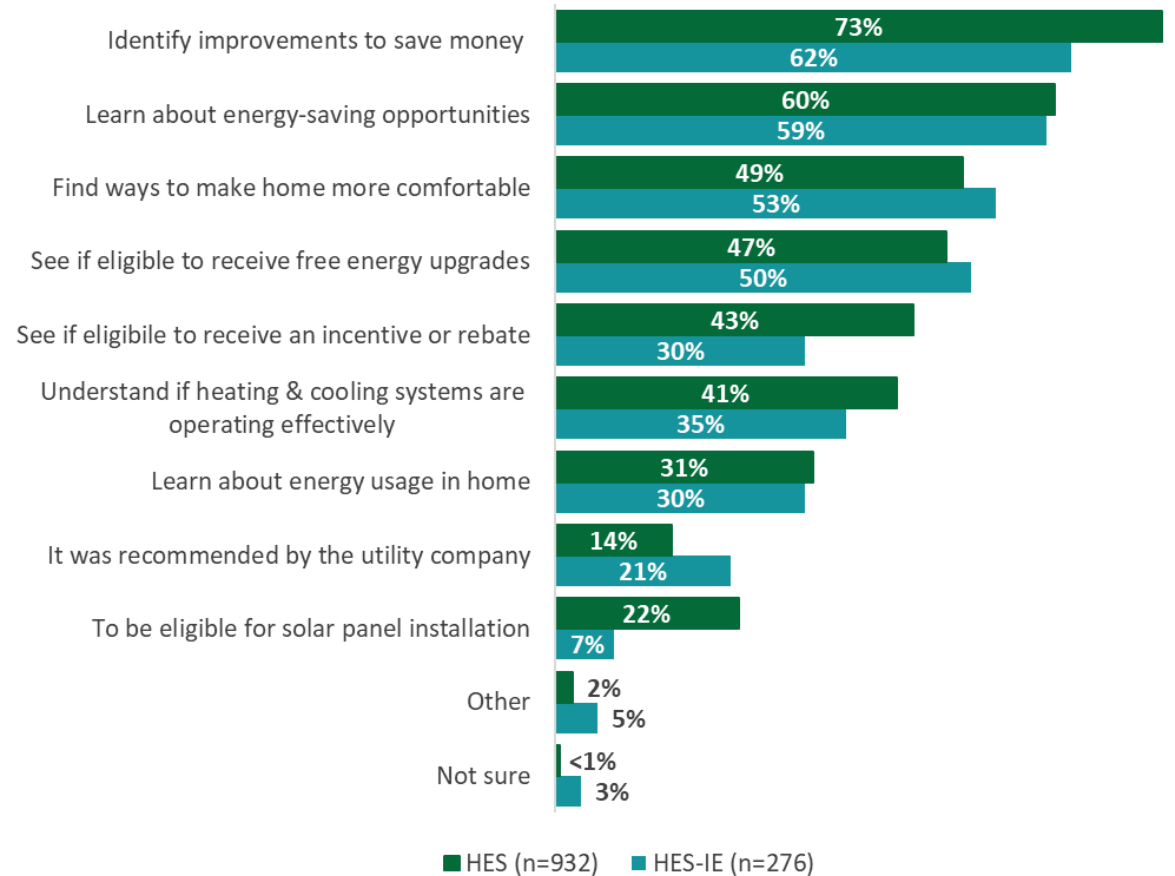
# Key Finding #7: Vendor and Participant Satisfaction

The program can improve information sharing with participants during and after the assessment.

Some participants had issues scheduling an assessment.

Home comfort is an important motivation for participating.

## Reasons for Participating in HES or HES-IE



# Recommendations for Key Finding #7

7A: Ensure technicians walk through the findings of the assessment and next steps with HES-IE participants and consistently follow-up with next steps.

7B: Improve customer service experiences for customers looking to schedule an assessment or receive additional information.

7C: Follow up with all participants to remind them about recommended measures and provide additional information.

VIRTUAL AUDITS OFFERED DURING THE PANDEMIC HAD LIMITED UPTAKE AND PARTICIPANTS WHO RECEIVED A VIRTUAL AUDIT HAD 25% LOWER EX-ANTE SAVINGS THAN THOSE WHO HAD NOT RECEIVED A VIRTUAL AUDIT.

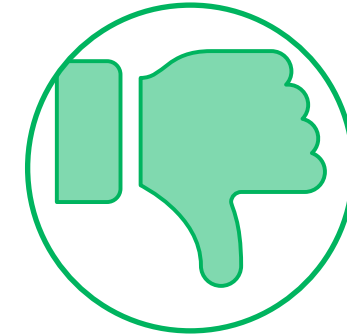
# Key Finding 8: Virtual Audits



Only 12% of eligible HES participants (who received an audit after March 2020) opted for a virtual audit



Virtual audit participants had a lower average ex ante savings (7.7 MMBtu) than those who did not receive a virtual audit (10.3 MMBtu), a 25% difference



Vendors cited issues with virtual audits: no follow-up from customers for in-person component, spotty internet service, inadequate compensation from the program

# Recommendations for Key Finding #8

8A: Consider adopting stricter guidelines for virtual audits to ensure access to savings opportunities and compensating vendors for the additional time needed to conduct the virtual pre-assessment.



COLLECTIVELY, THE RESIDENTIAL SINGLE-FAMILY AND MULTIFAMILY INCOME ELIGIBLE PROGRAMS ARE EFFECTIVELY REACHING DISADVANTAGED HOUSEHOLDS.

# Key Finding #9: Results

**Savings from the energy efficiency programs are generally distributed the same as population distributions**, which suggests programs and savings are proportionally reaching non-income eligible and income-eligible customers.

Program	Electric		Gas	
	% Savings	% of Homes	% Savings	% of Homes
Non-Income-Eligible	67%	73%	68%	70%
Income Eligible	33%	27%	32%	30%

*% of Savings = Percent of total residential portfolio savings for given fuel type*

*% of Homes = Percent of homes in census block groups with relevant fuel service*



THE RESIDENTIAL PROGRAM PORTFOLIO IS REACHING DISADVANTAGED AREAS THROUGH THE INCOME-ELIGIBLE (IE) PROGRAMS AND LOCATIONS WITH HIGH SAVINGS.

## IE electric programs

- Are *somewhat* underserving areas with high concentrations of low income and single-family housing.

## Non-IE electric programs

- Tend to achieve savings in areas with high concentrations of high-income or single-family homes and not in areas with high concentrations of equity-related demographics

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IE program electric and gas savings rates are positively correlated with all examined variables\*.

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Higher concentrations of examined variables\* tend to have higher levels of savings relative to consumption

*\*English isolation, low incomes, moderate incomes, multifamily housing, renter-occupied housing, pre-1950 construction, or structures on the state distressed list*



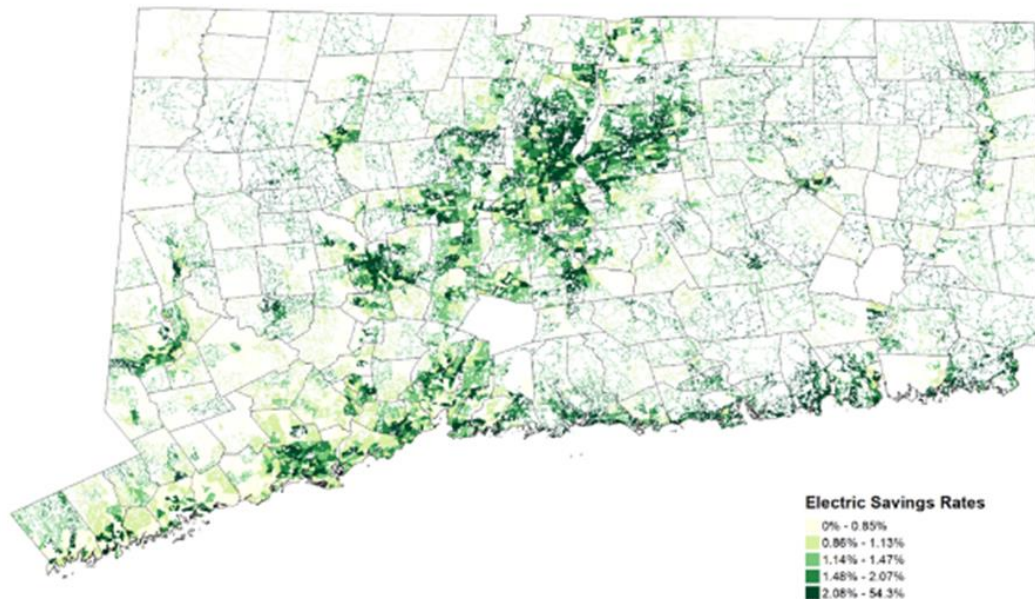
DESPITE REACHING DISADVANTAGED AREAS GENERALLY,  
THE PORTFOLIO UNDERREPRESENTS RURAL AREAS AND  
SINGLE-FAMILY, LOW-INCOME HOUSEHOLDS

# Key Finding #11: Results

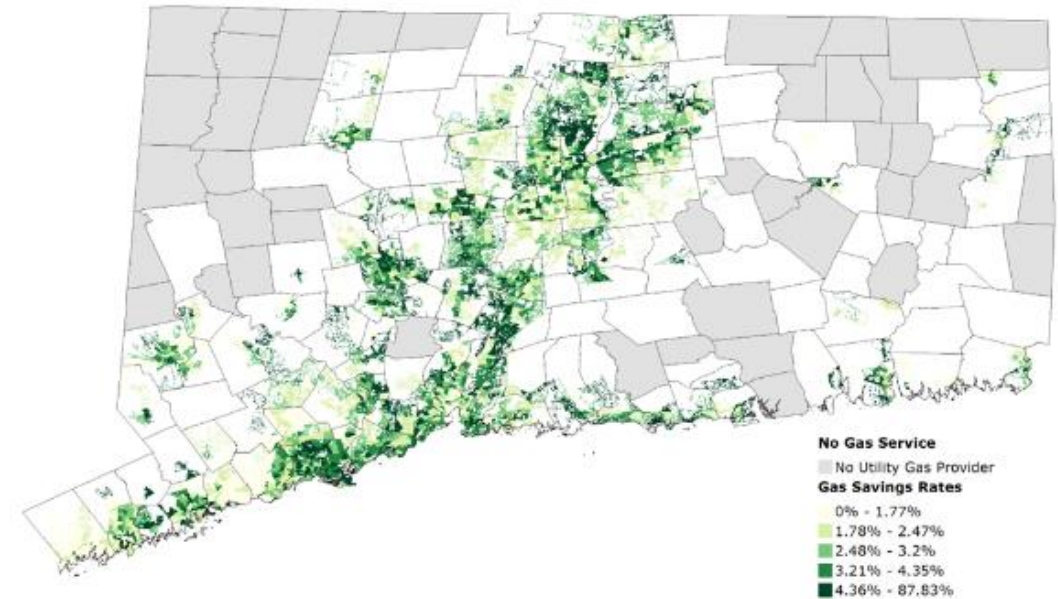
Across the whole portfolio, electric and gas savings are concentrated in the urban areas – i.e., customers in urban areas disproportionately participated in residential programs relative to more rural portions of the state

Low-income, single-family households are also somewhat under-enrolled in the IE electricity programs (% of savings relative to % of households); not true for natural gas

## Electrical Savings Rate 2017-2020



## Gas Savings Rate 2017-2020



9A. Create program designs that dedicate more resources to renters and rural areas of the state.

9B. Devote additional income-eligible program resources to enrolling single-family homes.

SIGNIFICANT DELAYS IN DATA REQUEST FULFILMENT AND DATA QUALITY ISSUES ADVERSELY IMPACTED THE TIMELINESS OF THIS STUDY AND ITS ABILITY TO INFORM THE PLANNING PROCESS.

12A: Improve the rigor of data collection and management, as well as Data consistency between Eversource and UI.

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The team offered a series of specific suggestions, some of which more recent data management process changes by both Companies may address

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Impending data-focused studies as part of the Cross-Cutting contract (X2232 and X2238) will explore the updated data processes, as well as evaluability, more comprehensively and offer recommendations as needed





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A photograph of a brick wall with a sign. The sign is rectangular and mounted on the wall. It features the letters 'NMR' in large, green, 3D block letters. Below 'NMR', the words 'Group, Inc.' are embossed in a smaller, grey font. The sign is set against a background of red bricks.

**NMR**

Group, Inc.