Goals for Today's Call

Follow-up on natural gas weatherization savings memo

Provide a "sneak preview" of the in-progress R1983 draft report

Agenda

- Quick refresher on R1983 scope
- Study Status & Timing
- Responses to questions on interim gas wx and NTG memos
- Key findings

Scope: Three Primary Elements

Impact

- Billing Analysis
  - Gas: air sealing, duct sealing and insulation
  - Electric: lighting
- Engineering Analysis, including building simulation (all other measures)

Process

- Participant Surveys, including ISR and NTG
- Stakeholder Interviews
- Program Materials Review

Profiling *(Covers all residential programs, not just HES/HES-IE)*

- Block Group-level Participation Analysis

Study Status

Done

- All primary data collection
- All preliminary analysis, including profiling
- Memos to inform recent PSD update
- Identified key findings

In progress

- Developing official set of cross-task recommendations
- Drafting report

Timing

- Draft review (of report) to EA Team by end of September

Responses to Comments on Interim Memos

Gas Wx: Major Points/Recurring Themes

1. The savings are very low; can we get a deeper exploration of the causes?

- **Yes.** We'll get into that today (and in the draft report) in more detail. There's no one reason, but we've developed a body of evidence to provide context for the lower savings.

2. Do the reported savings include duct sealing?

- **No.** Duct sealing savings are separate.

3. Can you provide more granular results (by vendor, heating system type, etc.)?

- **Yes and no.** Due to sample size limitation, more granular results are often unreliable. We will report what we can.

4. Did you also look at delivered fuels?

- **Yes**. We made engineering adjustments (to account for differences in homes and heating systems) to the natural gas billing analysis to estimate heating oil and propane savings; had similar realization rates

NTG: Major Points/Recurring Themes

1. Can you clarify how we are developing the net savings values for LEDs?

- We recommend **NTG ratio of 72% for the PSD** but will not apply it to billing analysis results for lighting (as billing analysis results for lighting are net).

2. Can we qualitatively estimate NPSO?

- **No**. We set out to measure it but could only ask vendors a limited set of questions, given the breadth of the interview guide. We will recommend that future evaluations avoid extensive process and NTG question batteries in the same interview guide for this set of market actors.

3. Can you provide more information on response rate?

- **Yes**. The overall report will include an extensive methodology section, including response rate and NTG methods

Impact

Three Key Impact Findings

Evaluated natural gas* weatherization savings were significantly lower than the programs' reported savings.

There is a downward trend in pre-program natural gas consumption* by subsequent HES & HES-IE cohorts.

R1983 lighting savings are nearly identical to the previous evaluation (R1603).

**Also impacts weatherized delivered fuel participants – and growing portion of both programs – since the evaluation team leverages the natural gas billing analysis to evaluate those fuel types*

Impact Finding #1: Evaluated weatherization savings were significantly lower than the programs' reported savings

Statewide savings (therms/year) for 2019 participants

Program	Core (Air Sealing Only)			Rebated (Air Sealing & Insulation)		
	R1983 (2019 Participants)	**R1603** (2015 & 2016 Participants)	**Reported** (2019 Participants)	**R1983** (2019 Participants)	**R1603** (2015 & 2016 Participants)	**Reported** (2019 Participants)
HES	**13**	64	109	**63**	218	264
HES-IE	**13**	59	130	**133**	217	360

Impact Finding #1: Evaluated weatherization savings were significantly lower than the programs' reported savings

Benchmarking. Savings lower than, but closer to, several recent evaluations in neighboring states (relative reported savings).

Program	State	Cohort	Ex Post Wx Savings
EnergyWise Single Family	Rhode Island	2017–2018	96
Income Eligible Single Family	Rhode Island	2015–2016	124
Home Energy Services	Massachusetts	2015–2016	130

More soon. Both MA and RI are going to undertake impact evaluation updates for their assessment programs soon. This will enable better comparison (i.e., more recent cohorts) and provide insights into "post-COVID" results.

Impact Finding #1: Evaluated weatherization savings were significantly lower than the programs' reported savings

Other Methods. Team also modeled natural gas weatherization savings via calibrated building simulation to supplement/corroborate the billing analysis.

Takeaway: Building simulation savings were higher than billing analysis – as they usually are – but **lower relative to similar building sim efforts, which supports lower billing analysis result**.

Program (Cohort Analyzed)	**Billing Analysis**	**Building Simulation**	**Difference** (Billing/Sim)
HES (CT: 2019)	63	158	40%
EWSF (RI: 2017–2018)	96	254	38%
Home Energy Services (MA: 2015–2016)	130	201	65%

Impact Finding #2: There was a downward trend in pre-program consumption by subsequent HES & HES-IE cohorts

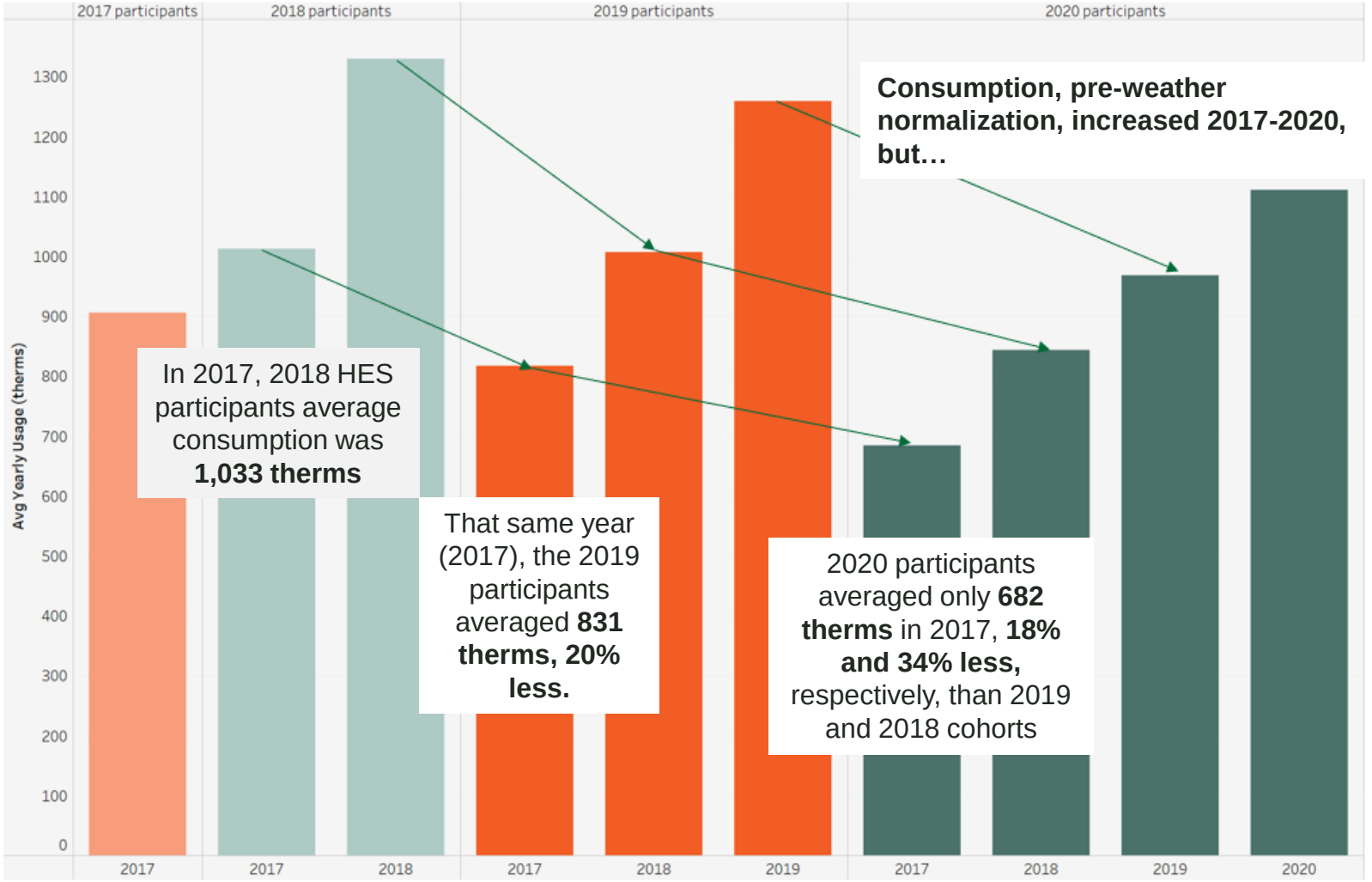
We see a notable year-over-year **decline** in pre-program consumption, which supports lower savings results for more recent participation cohorts.

Less consumption generally equates to less opportunity for weatherization savings

Takeaway: A comparable decrease in savings should be expected.

Reminder: R1603 analyzed an even earlier cohort (2015-16) – assuming longer-term trend.

Similar trends exists for HES-IE cohorts



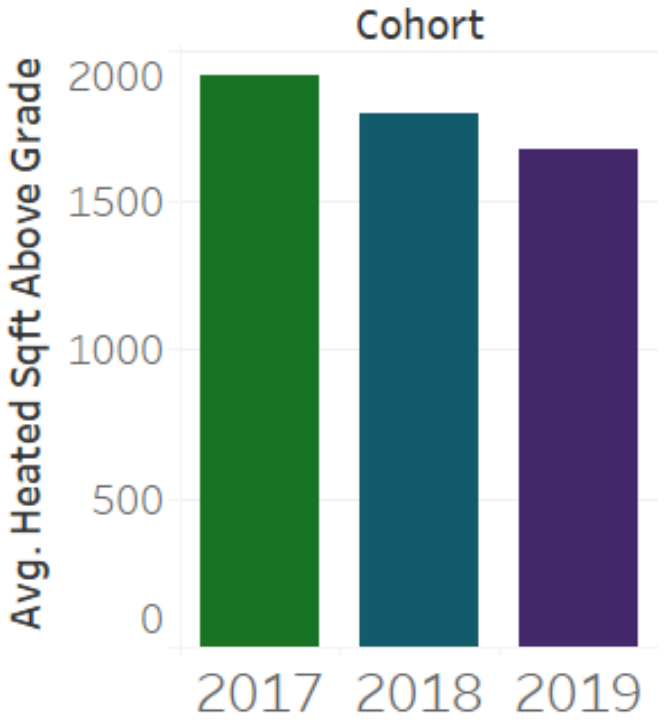
Impact Finding #2: There was a downward trend in pre-program consumption by subsequent HES & HES-IE cohorts

Why? The average decline in consumption could be the result of numerous, concurrent factors:

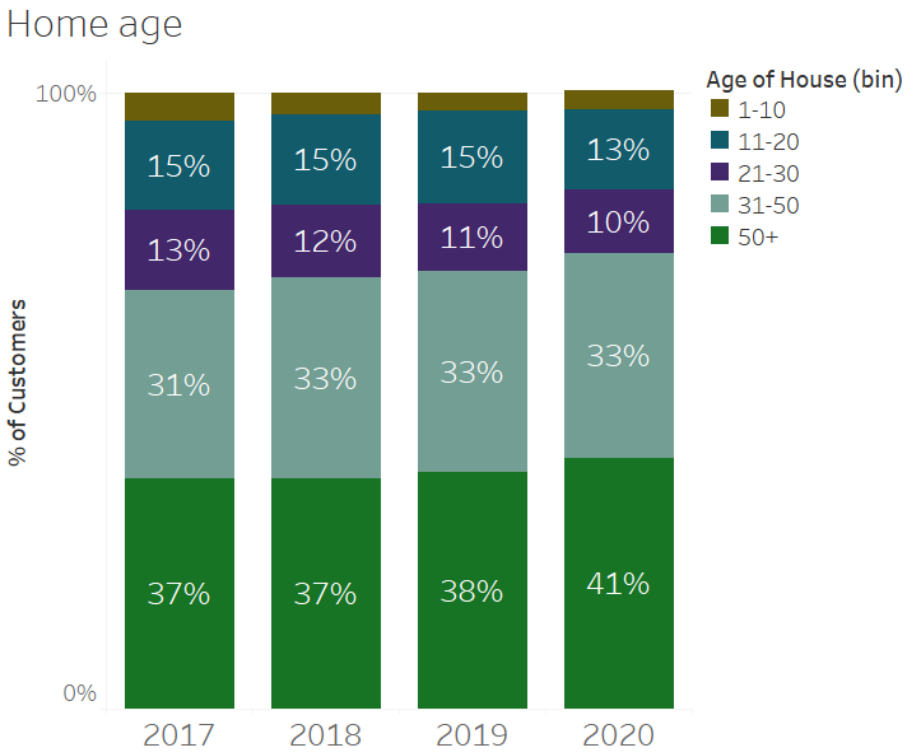
- Program maturation, i.e., customers with least efficient homes and highest bills have already participated (there is less “low hanging fruit”)
- Increasing saturation of condensing natural gas furnaces
- Increasing saturation of smart thermostats
- Increasing number of solar-focused participants (HES)
- Repeat program participation

Impact Finding #2: There was a downward trend in pre-program consumption by subsequent HES & HES-IE cohorts

Smaller Homes. The average conditioned space/participant has decreased over time. Consistent with lower consumption and savings.



Older Homes. Greater percentage of older homes over time. This homes can present opportunity, but also be harder to fully weatherize.



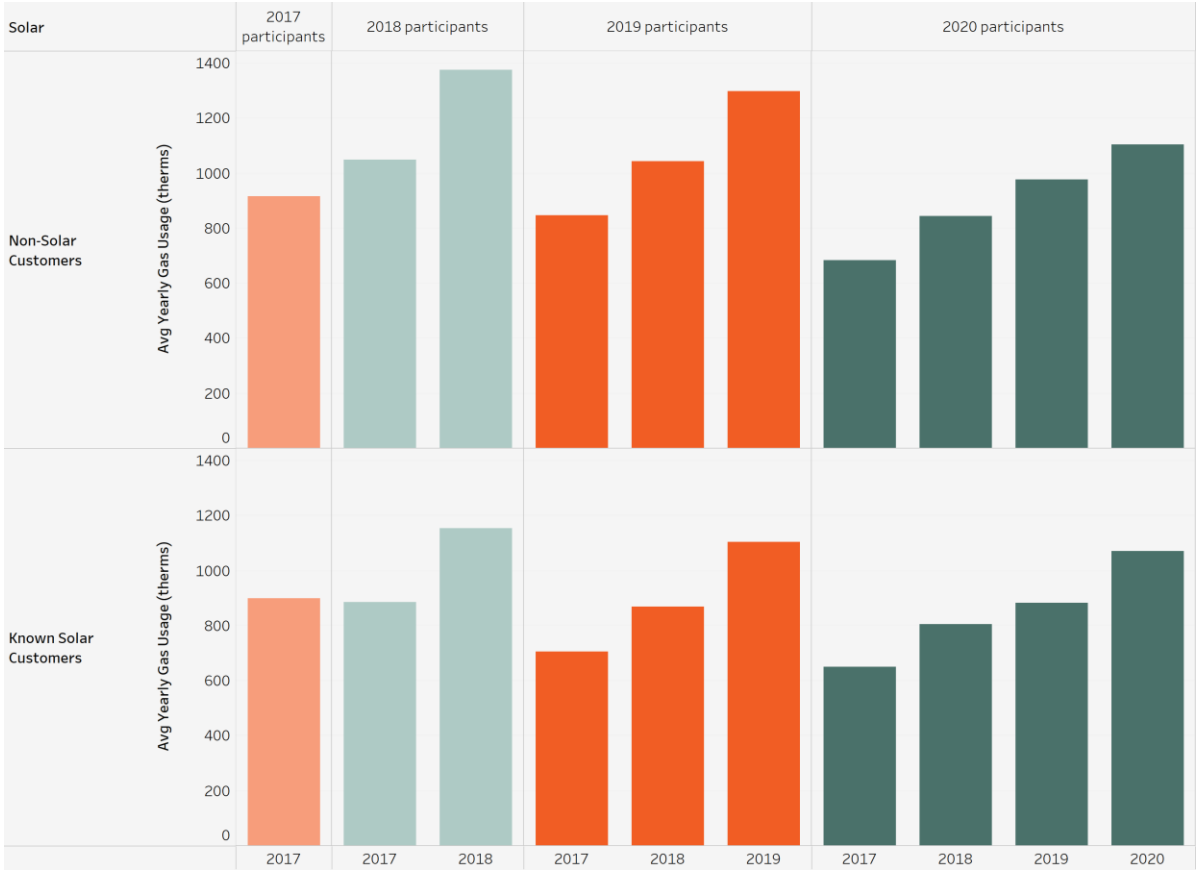
Impact Finding #2: There was a downward trend in pre-program consumption by subsequent HES & HES-IE cohorts

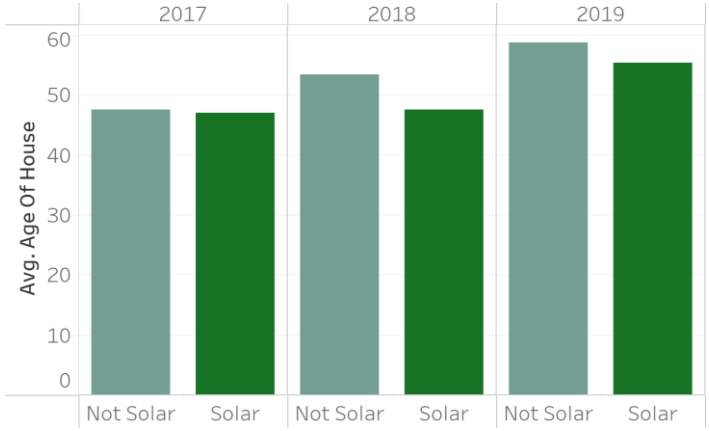
Slightly more participants (8%) were "known" solar accounts in 2019 - up from 6% in 2018 and 5% in 2017)

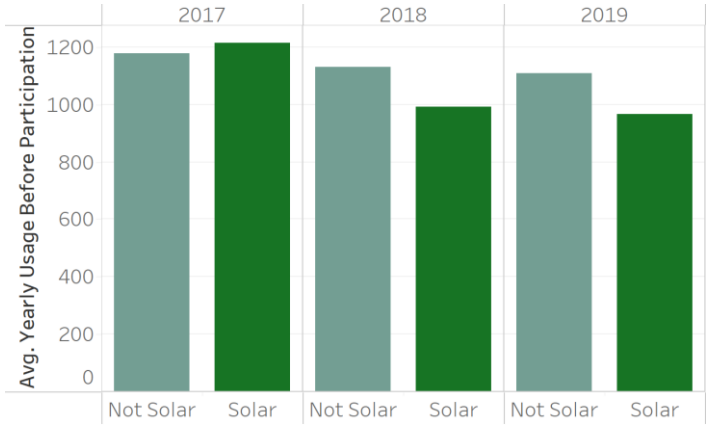
Solar participants showed same downward trend in consumption by cohort

Solar participants also tended to live in newer homes with less conditioned space

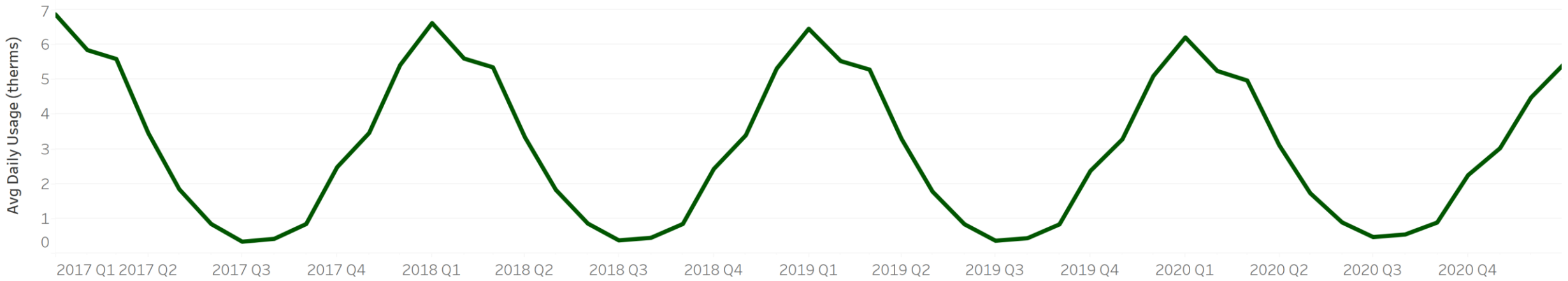
Takeaway: Greater solar participation is contributing to observed trends, but not likely responsible for them







Impact #2: What about COVID-19?



2019 participation is conflated with COVID-19 and associated lockdowns.

We do not see any sudden deviation in average consumption across the population at the onset of lockdowns.

There was an expected drop in the # of participants in early-mid 2020 which does limit our control group.

Takeaway: The data we have does not suggest a major shift in COVID-related usage, but the team's view is limited. Looking at a "post-COVID" cohort will reveal if observed changes are persistent or if they rebound.

Impact Finding #3: R1983 lighting savings are nearly identical to the previous evaluation (R1603).

Our team's billing analysis results mirror that of R1603, as well as recent evaluations in Rhode Island: EWSF (15-18 kWh) and IESF (18 kWh).

Program (Statewide)	Savings (kWh/bulb)		
	R1983 (2019 Participants)	**R1603** (2015 & 2016 Participants)	**Reported*** (2019 Participants)
HES	**18**	19	32
HES-IE	**17**	14	33

* After applying 65% NTG to PSD gross savings algorithm since billing analysis results are interpreted as net. (FYI: The updated NTG for lighting from this study is 72%.)

Impact: Other Notable Findings

Duct Sealing

- Also evaluated via billing analysis
- 8 therms/ participant (that received the measure, which was 38% of HES participants)

Smart Thermostats

- Recommending updated heating load input value (from this study) to replace current source (from 2012)
- Results in 60% “retrospective” realization rate

Others

- Many other measures had gross realization rate of 100% or close
- No/limited recommendations re: current PSD algorithm and input parameters

Process

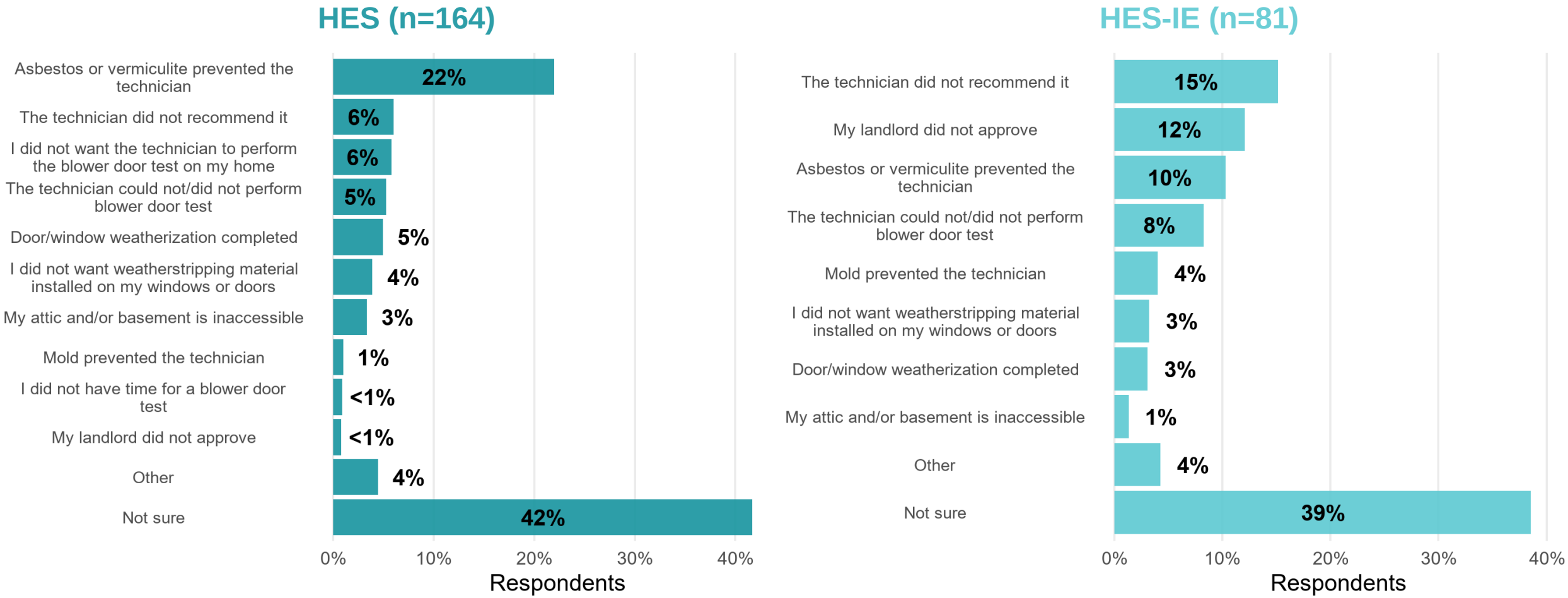
Three Key Process Findings

Asbestos / vermiculite was the top reason HES respondents gave for why they had not received guided air sealing in their homes; it was a top-three reason for HES-IE respondents

The gap between tracked and self-reported asbestos prevalence was seven times larger for HES-IE respondents than for HES respondents

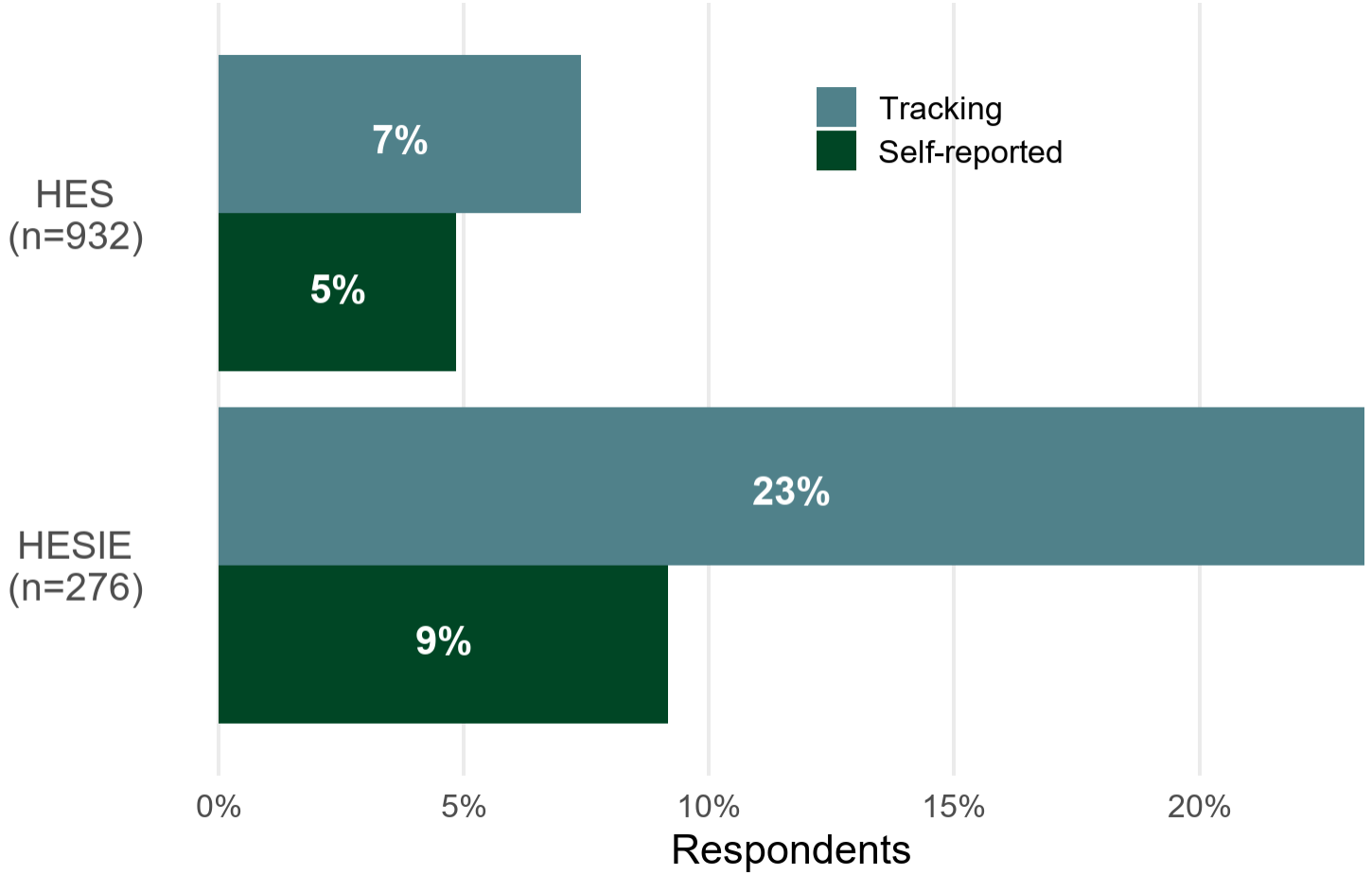
HES respondents were twice as likely as HES-IE respondents to say technicians had discussed add-on energy upgrades with them, i.e., they recalled a post-assessment “kitchen table” discussion

Process Finding #1: Asbestos / vermiculite was the top reason HES respondents gave for why they had not received guided air sealing in their homes; it was a top three reason for HES-IE respondents



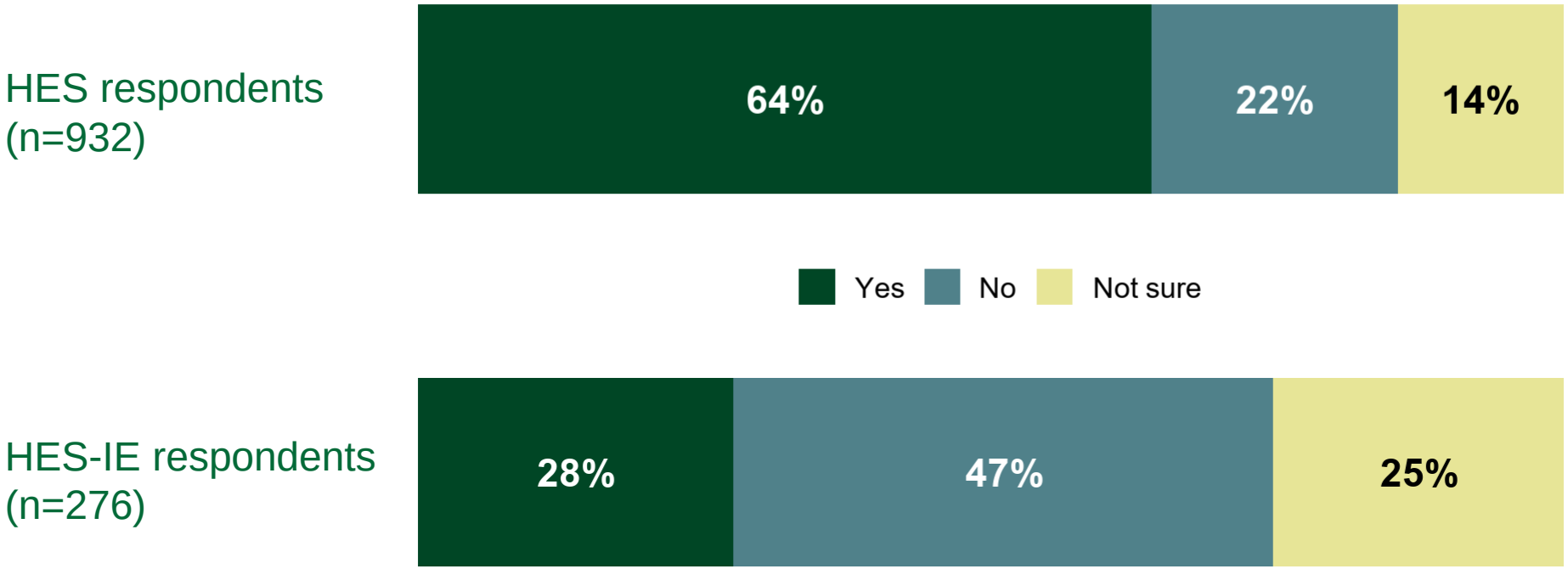
Base: respondents who self-reported not receiving a blower-door test and guided air sealing, both with and without a record of the upgrade in program tracking data

Process Finding #2: The gap between tracked and self-reported asbestos prevalence was seven times larger for HES-IE respondents than for HES respondents



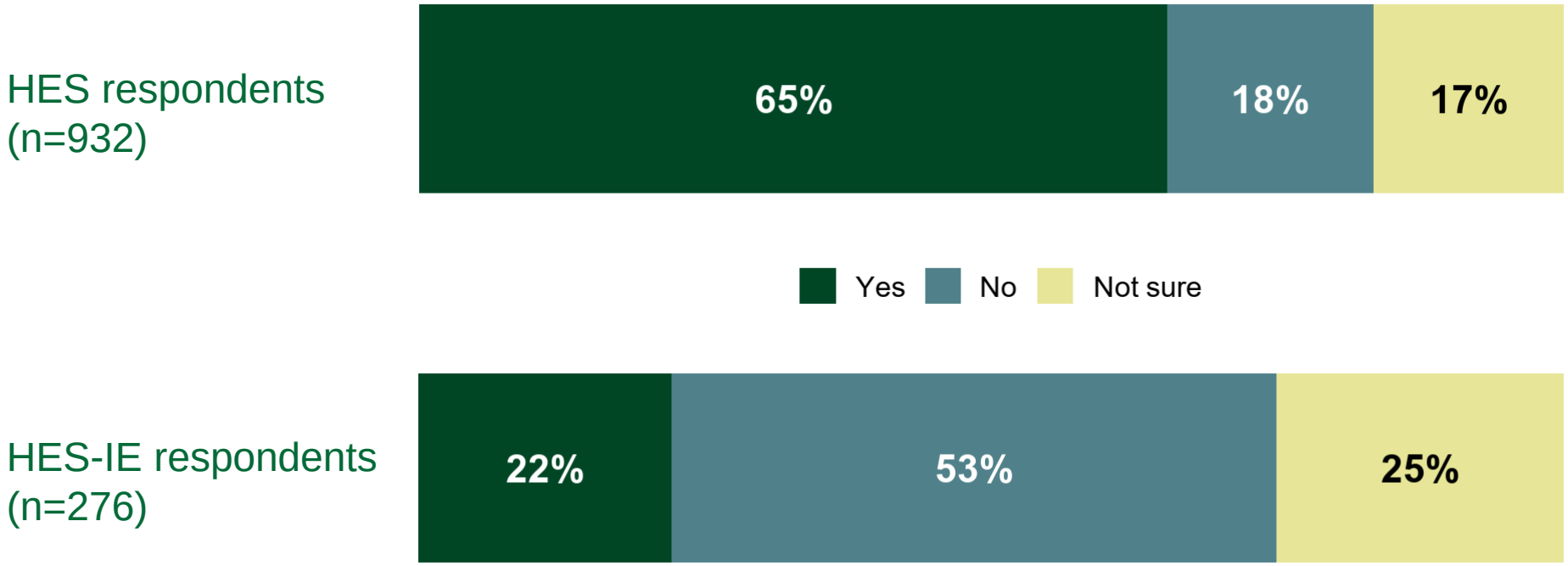
Process Finding #3: HES respondents were twice as likely as HES-IE to say they had discussed add-on measures with the technician

After the technician completed the home energy assessment, did he or she discuss any additional recommended energy upgrades with you?



Process Finding #3: HES respondents were twice as likely as HES-IE to say they had discussed add-on measures with the technician

Did the Home Energy Solutions technician discuss rebates with you during the assessment, including a review of which upgrades were available and how to apply?



Process: Other Notable Findings

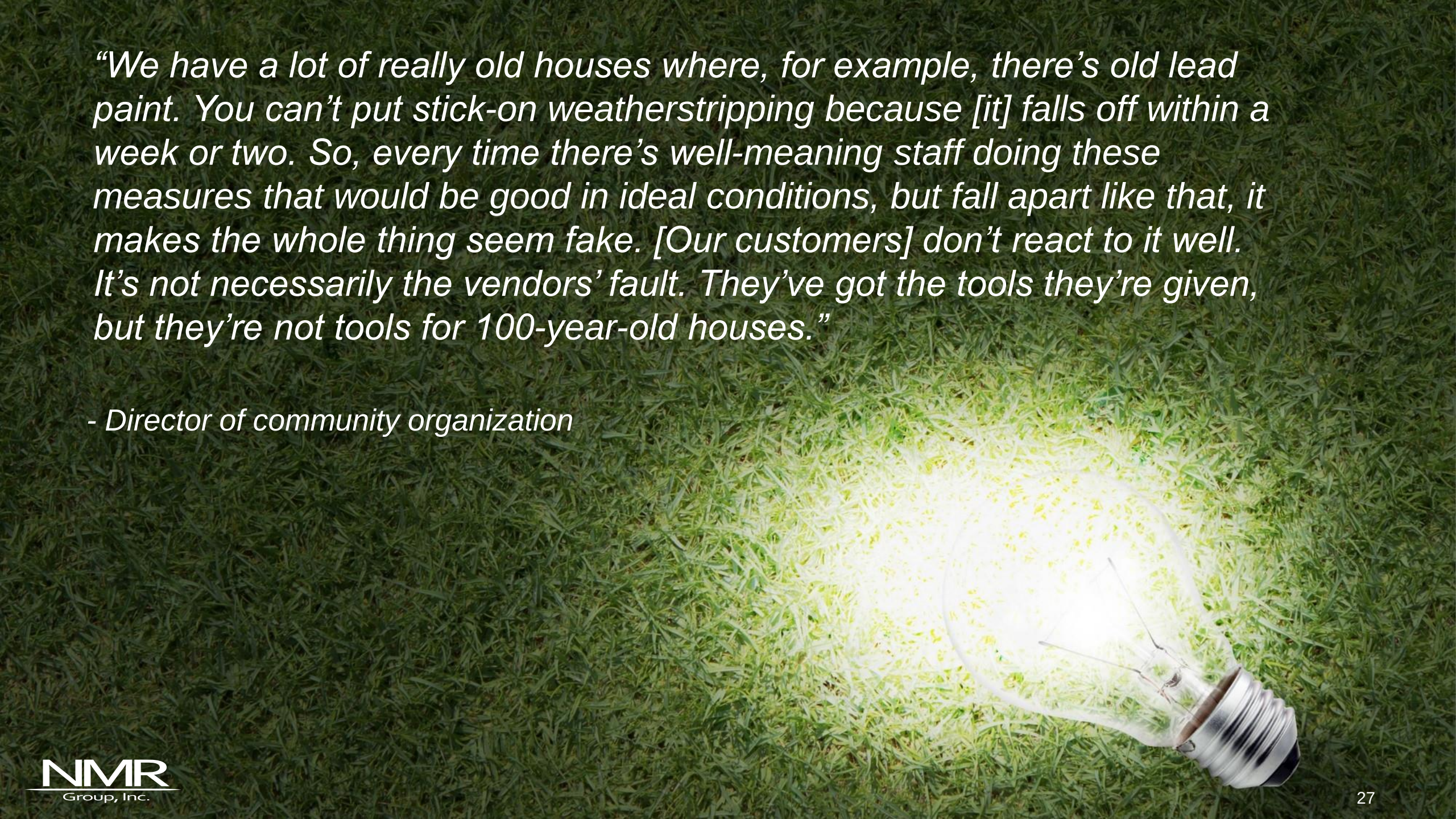
HES respondents were more satisfied with their overall program experience than HES-IE respondents (4.3 compared to 3.9 on a 1 to 5 scale); HES-IE respondents were more satisfied with a larger number of individual program elements

Most (10 of 13) vendor interviewees did not think Connecticut could meet its goal to weatherize 80% of all residential units by 2030, or was on track to meet it without significant funding and market changes

Most (12 of 14) vendor interviewees agreed a workforce development program would help to increase the pool of qualified lead technicians, with half (7) saying there were shortages of qualified personnel

“We have a lot of really old houses where, for example, there’s old lead paint. You can’t put stick-on weatherstripping because [it] falls off within a week or two. So, every time there’s well-meaning staff doing these measures that would be good in ideal conditions, but fall apart like that, it makes the whole thing seem fake. [Our customers] don’t react to it well. It’s not necessarily the vendors’ fault. They’ve got the tools they’re given, but they’re not tools for 100-year-old houses.”

- Director of community organization



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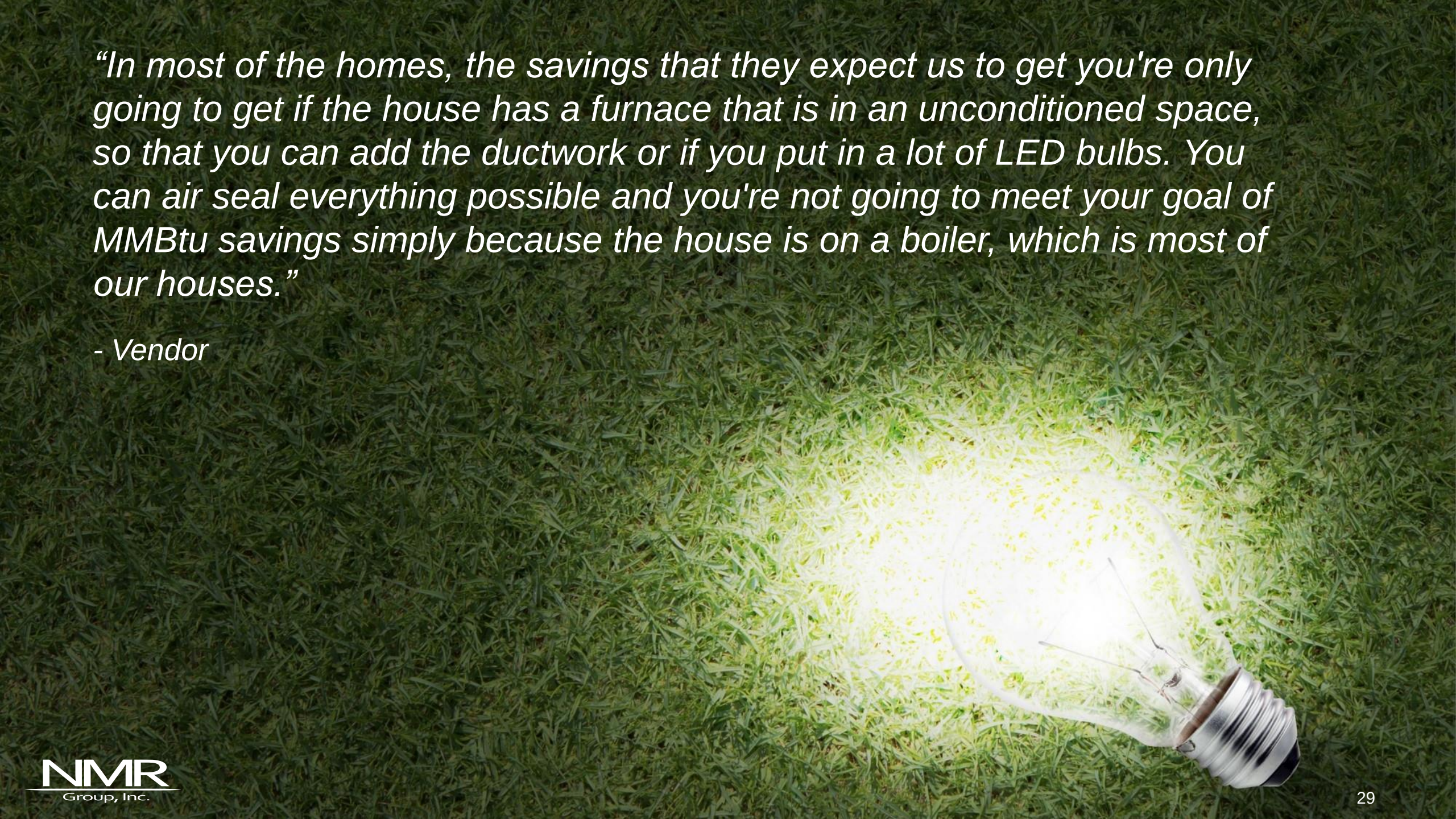
“There are remedies out there, but as long as I’ve been working on this… it’s a very complicated bunch of silos. The EEB chair is doing a really good job identifying where these silos are and working on how to merge them so that a home energy concierge would be able to say, here are the resources we have for your home to receive the necessary energy efficiency upgrades. But right now, even the vendors don’t have the right vocabulary, the right literature. Homeowners get their air sealing and light bulbs, they get their list of suggestions on what needs to be done, but that’s as far as it goes”

- Member of town energy commission

“In most of the homes, the savings that they expect us to get you're only going to get if the house has a furnace that is in an unconditioned space, so that you can add the ductwork or if you put in a lot of LED bulbs. You can air seal everything possible and you're not going to meet your goal of MMBtu savings simply because the house is on a boiler, which is most of our houses.”

- Vendor



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Process Finding #4: More-recent HES respondents were significantly less likely to say they were interested in lighting and smart thermostat upgrades when they first signed up for the assessment

Statistically significant result at 90% conf. level