



Quantifying Behavioral Spillover: the Overlooked, Uncounted Source of Program Savings

Jane Hummer &
Debbie Brannan

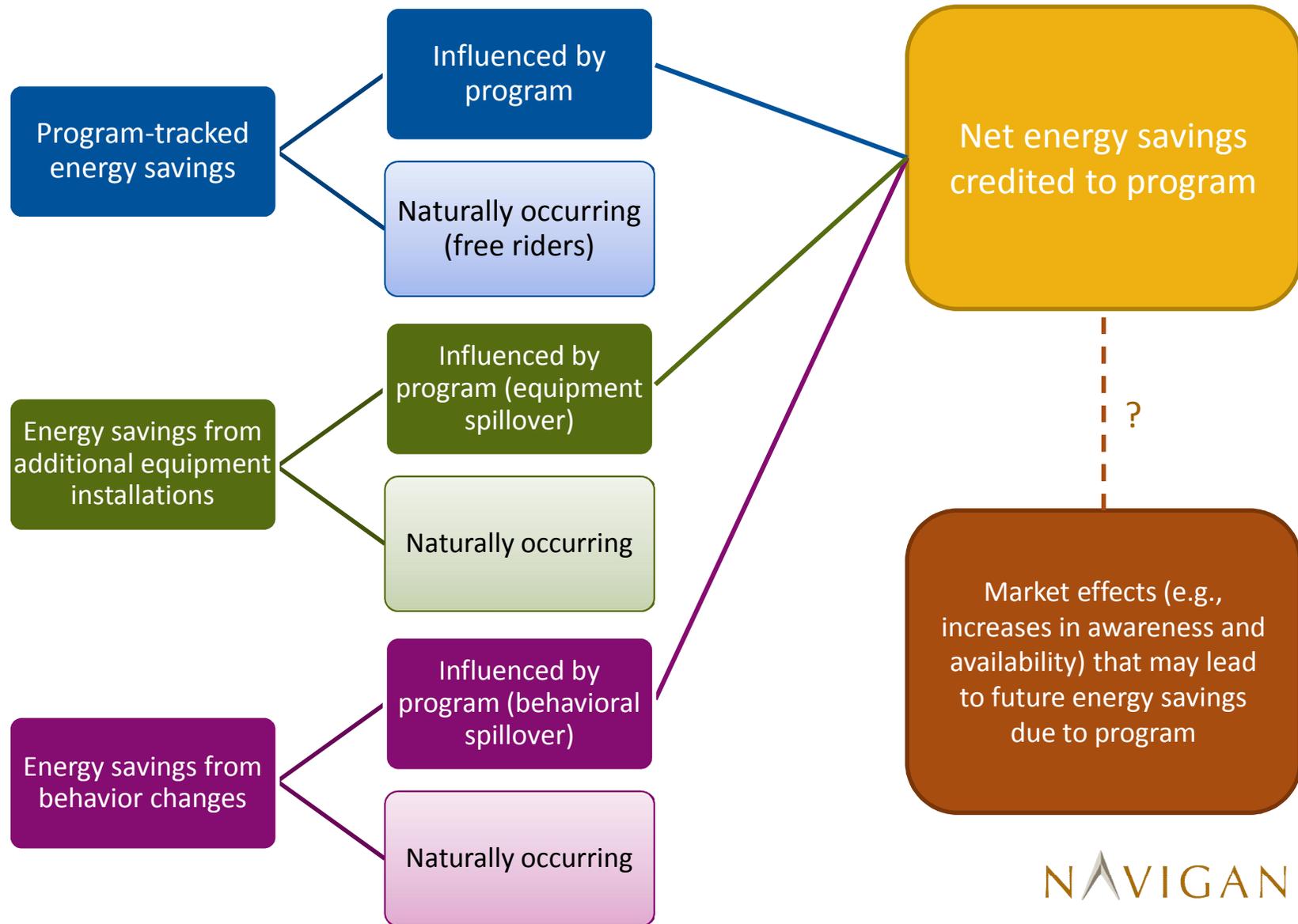
December 8, 2014
Behavior, Energy & Climate
Change Conference
Washington, DC



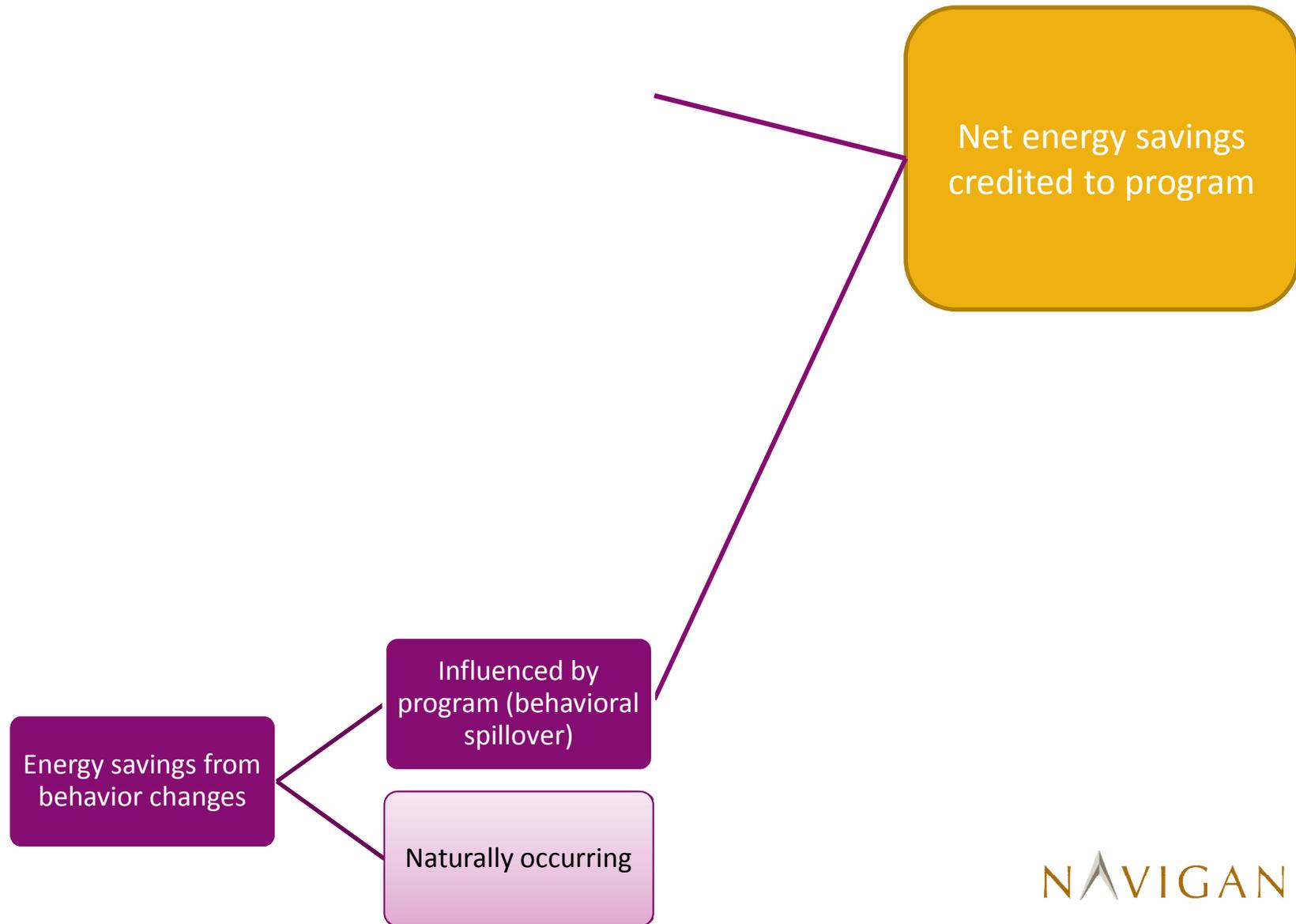
“We tend to overvalue the things
we can measure and undervalue
the things we cannot.”

- John Hayes

Capturing the full range of program impacts



Capturing the full range of program impacts



Project context

- “First touch” programs encourage customers to engage with energy efficiency for the first time and prime them to participate in future programs.
- Relatively low energy savings per participant.
- Previous participant surveys indicated the programs influence participants to make other equipment installations and behavior changes.
- Goal: to develop a simple yet defensible method for estimating spillover (including equipment and behavior) across several residential programs in DTE’s portfolio using participant surveys.

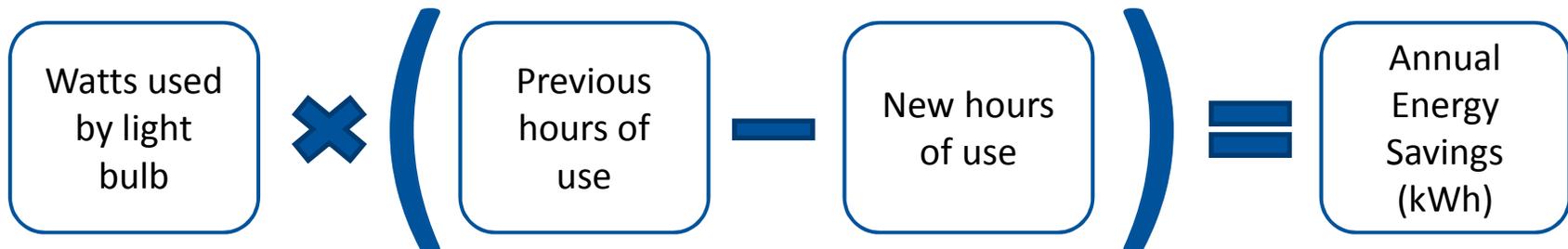
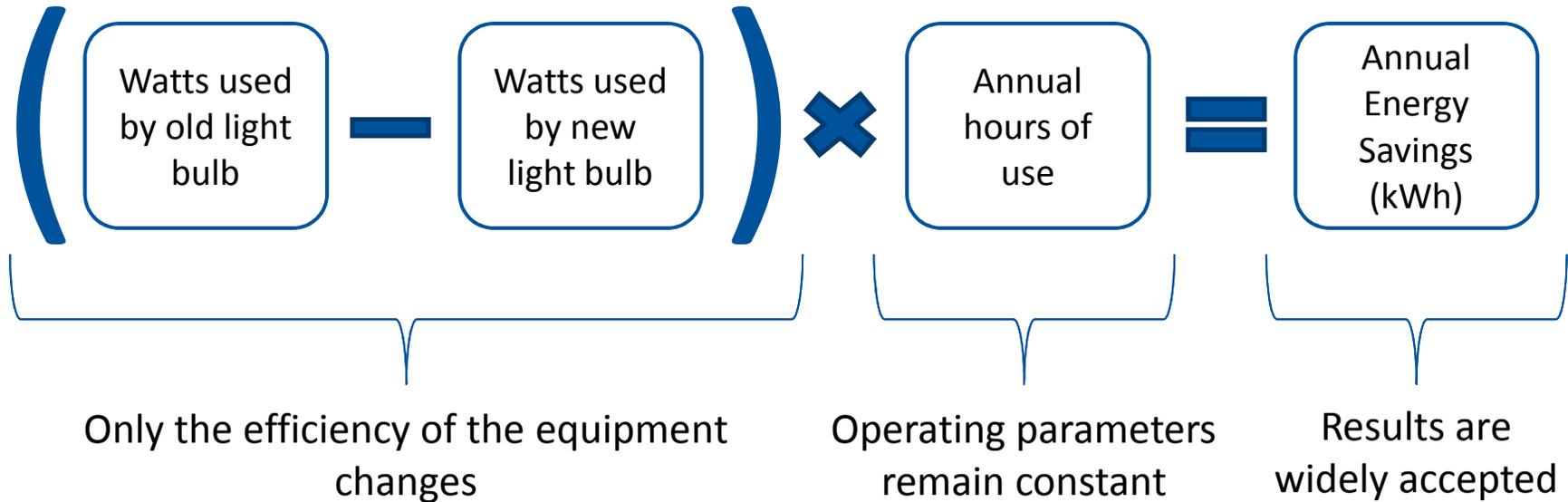
Challenges of self-reports

- Residential customers may **lack technical knowledge** about the efficiency of their home and its equipment and appliances.
- Questions about changes in hours of use can be **cognitively challenging**.
- Long surveys with challenging questions tend to have **lower completion rates** than short, easy surveys, leading to non-response bias.
- **Social desirability bias** may lead respondents to exaggerate their behavior changes or mention behaviors that they had already adopted prior to the program's influence.

Typical approach to savings estimation

- Programs use “deemed savings” databases for common energy efficiency measures.
- Deemed savings estimates are based on:
 - » The known efficiency of the newly installed equipment
 - » Assumptions about the efficiency of the old equipment
 - » Assumptions about the operating parameters of the equipment
 - e.g., hours of use, thermostat set-point, number of laundry loads per week, etc.
 - » Assumptions about the home’s characteristics
 - e.g., size, level of insulation, heating fuel type, etc.
 - » The assumption that the equipment will remain installed for a certain percentage of its entire useful life
- Assumptions are based on averages from past evaluations, baseline studies, etc.
- Impact evaluations verify these assumptions to the extent possible for a sample of participants (via secondary research, phone, or on-site visits).

Turning the equation around



Selecting behaviors to analyze

Changes to how often or for how long you use lighting, electronics, or appliances in your home

- Turn off lights
- Line-dry clothes
- Watch TV for fewer hours per day
- Play video games for fewer hours per day
- Use computer for fewer hours per day
- Use electronics for fewer hours per day
- Unplug electronics when not in use
- Plug electronics into smart strip

Changes to the amount of heating, air conditioning, or hot water that you use

- Use air conditioning for fewer hours
- Use fans instead of air conditioning
- Set air conditioner to higher temperature
- Use less air conditioning (general)
- Set heating to lower temperature
- Program thermostat
- Wash laundry in cold water
- Adjust water heater thermostat
- Change furnace filter

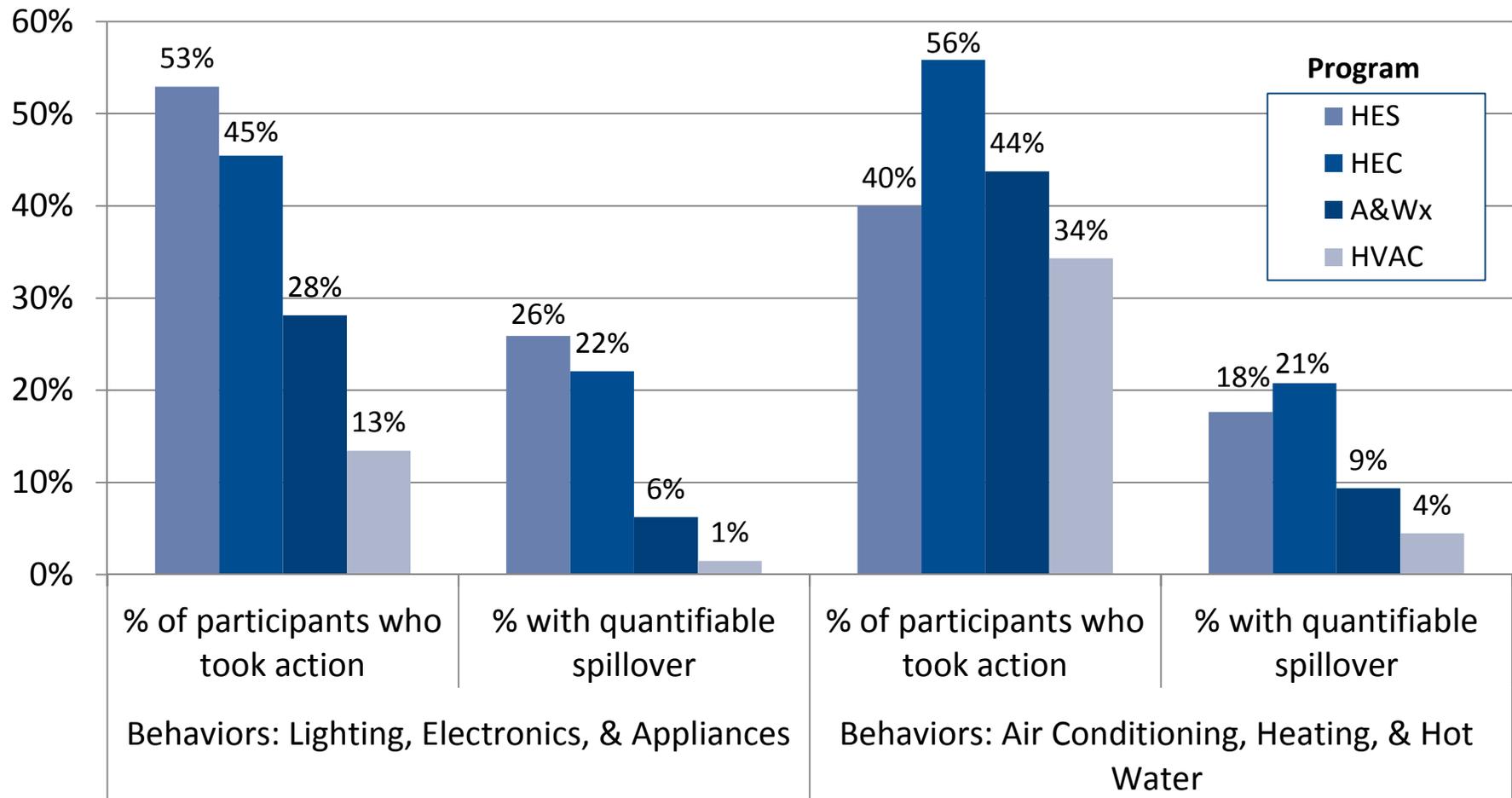
Designing friendly surveys

- Use neutral language and non-leading questions; ask about changes to energy-related behaviors, not energy saving behaviors
- Limit the number of follow-up questions to highly program-influenced behaviors
- Don't expect respondents to pull out a calculator; break questions about reductions in usage into two parts
- Use terms that laypeople will recognize; the interviewer is also a layperson
- Don't ask questions you won't use in the analysis

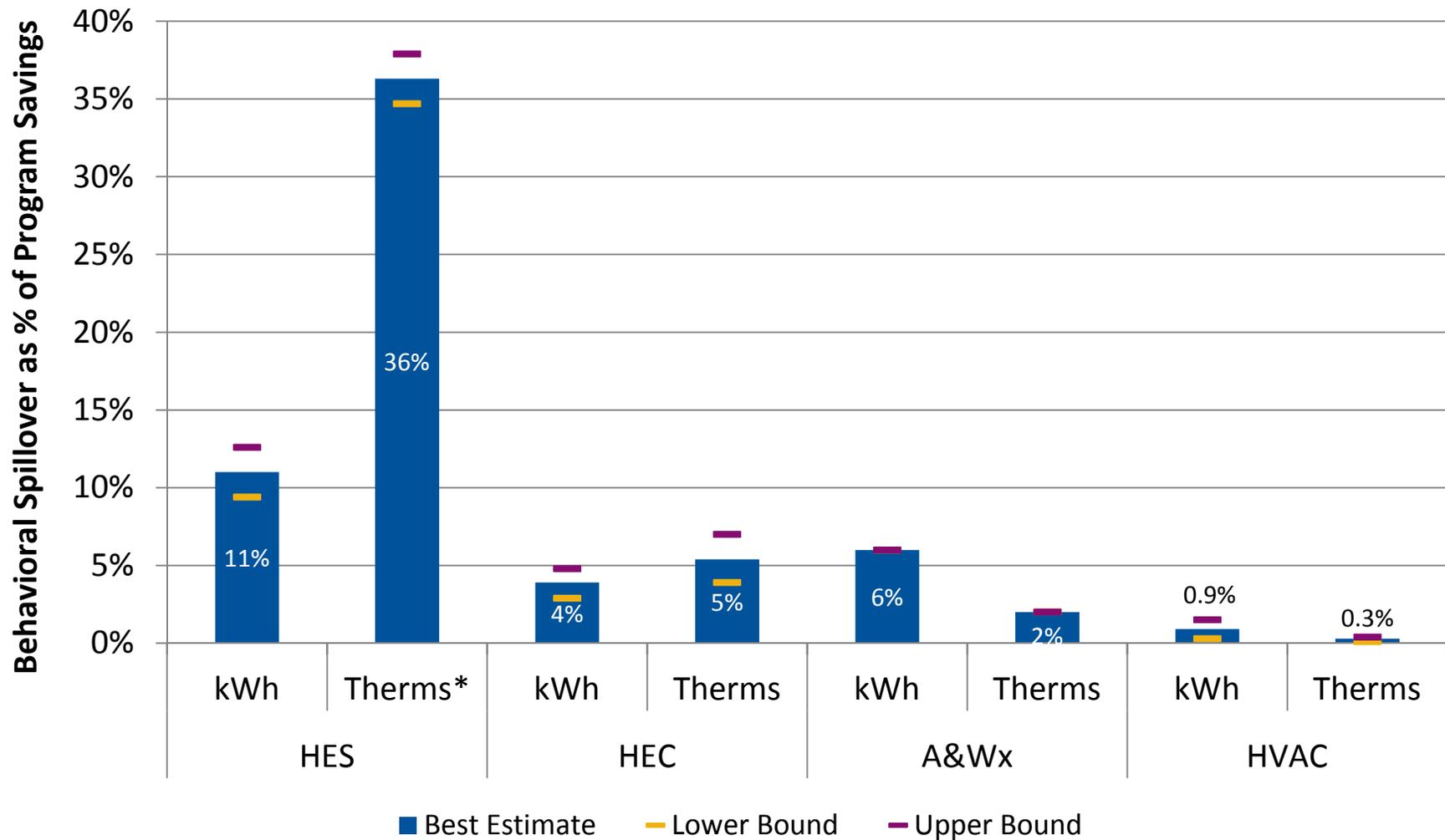
Structuring the analysis

- Design the analysis before the survey
- Review the deemed savings database or technical reference manual for relevant equipment
- Make a list of inputs and assumptions for each type of equipment
- Choose questions that participants can reasonably answer (e.g., water heater fuel type)
- Make data-driven assumptions for technical specifications that participants are unlikely to know (e.g., furnace efficiency); use ranges to account for uncertainty in assumptions

Results



Results



* Note that the majority of program-installed measures were electric measures, not gas, so this is a large percentage of a relatively small number.

“If you cannot measure it, you cannot improve it.”

- Lord Kelvin

Success factors

Select behaviors

- Review open-ended responses from past participant surveys
- Focus on a limited list of common behaviors

Review relevant savings algorithms & assumptions

- Review the accepted energy savings algorithms in technical reference manual
- Identify equipment and operating parameters with the biggest impact on energy savings

Develop survey questions & savings algorithms

- Ask no more than 3 simple follow-up questions per behavior, focused on information that only respondents could provide
- Make conservative assumptions when necessary

Design and field surveys

- Structure survey logic to identify full range of program-influenced behavior changes but focus follow-up questions on a few significant behaviors
- Avoid prompting respondents to mention specific behaviors

Analyze data & quantify savings

- Develop a user-friendly spreadsheet to facilitate consistent analysis across programs
- Use ranges rather than point estimates to appropriately reflect uncertainty

Questions?

Jane Hummer

jane.hummer@navigant.com

303-728-2506

Appendix: Programs

- **HEC** (Home Energy Consultation Program): In-home energy consultations and direct installation of CFLs, low-flow faucet aerators and showerheads, pipe wrap, programmable thermostats, and LED nightlights
- **HES** (now called “On-Line Energy Audit Program”): Online audit and energy savings kit including CFLs, low-flow showerheads, faucet aerators, and LED nightlights
- **A&Wx** (Audit & Weatherization): home performance assessments and rebates for insulation, windows, HVAC measures, and air sealing
- **HVAC**: rebates for high-efficiency boilers, furnaces, air conditioners, water heaters, thermostats, and tune-ups