

ILLUME



# BENCHMARKING BEHAVIORAL SAVINGS

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ILLUME Advising, LLC  
November 3, 2015

This Work Supported By:



U.S. DEPARTMENT OF  
**ENERGY**

Michael Li



Anthony Fryer, Jessica Burdette

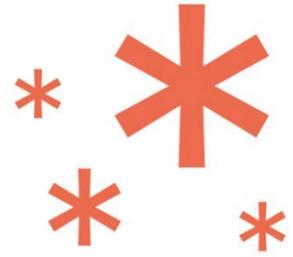
# Acknowledgements

DOE (and CARD) reports prepared by:

- Anne Dougherty, Founder
- Dr. Courtney Henderson, Senior Evaluation Advisor
- Amanda Dwelley, Directing Advisor
- Mallika Jayaraman, Research Coordinator

*with subcontractors to CARD report:*

- Dr. Edward Vine, Staff Scientist, Lawrence Berkeley National Laboratory
- Dr. Susan Mazur-Stommen, Founder, Indica Consulting



## Webinar series

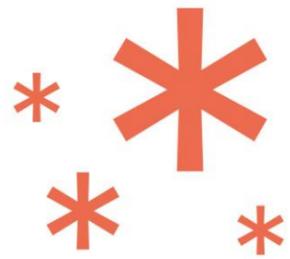
### Upcoming SEE Action Webinars

- |              |  |               |
|--------------|--|---------------|
| Oct 27       | SEE Action:<br>Isn't it all behavior change anyway?                            | 2pm ET        |
| <b>Nov 3</b> | <b>SEE Action:<br/>Benchmarking Behavioral Programs on Savings and Impacts</b> | <b>2pm ET</b> |
| Dec 2        | SEE Action:<br>Behavior Change Strategies in Traditional EE Programs           | 2pm ET        |



**Amanda Dwelley** is a Directing Advisor at ILLUME. Amanda focuses on market research and evaluation of pilot and behavior-based energy efficiency programs. She is involved in planning experimental and quasi-experimental design that facilitates rigorous evaluation, and developing methods to evaluate new and emerging program models.

**Amanda Dwelley, Directing Advisor**

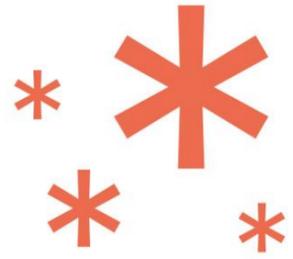


## Working definition of “behavioral programs”

Adapted California working definition of “behavioral programs” to differentiate these programs from traditional, incentive-based DSM programs.

- Rooted in social science: Use **social-science based** theories and behavioral intervention strategies.
- Evaluable: Energy savings impacts are **quantifiable** using industry-standard approaches.

+ *additional criteria for purpose of benchmarking:*  
savings results must be provided in a manner that  
**allows for comparisons** across our taxonomy



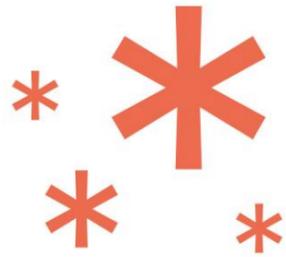
# Working definition of "behavioral programs"



An Approach



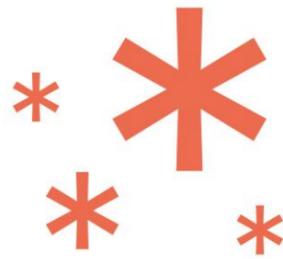
Not a Target



## Eight behavioral strategies in our definition

*List based on the CA whitepaper "Paving the Way for a Richer Mix of Behavioral Programs," and the "ACEEE Field Guide to Utility-Run Behavior Programs"*

- Commitment (including goal-setting)
- Feedback
- Follow-through
- Framing (e.g., choice architecture)
- In-person interactions
- Rewards or gifts
- Social norms
  
- + *Multi-pronged or "stacked" strategies – use two or more strategies.*



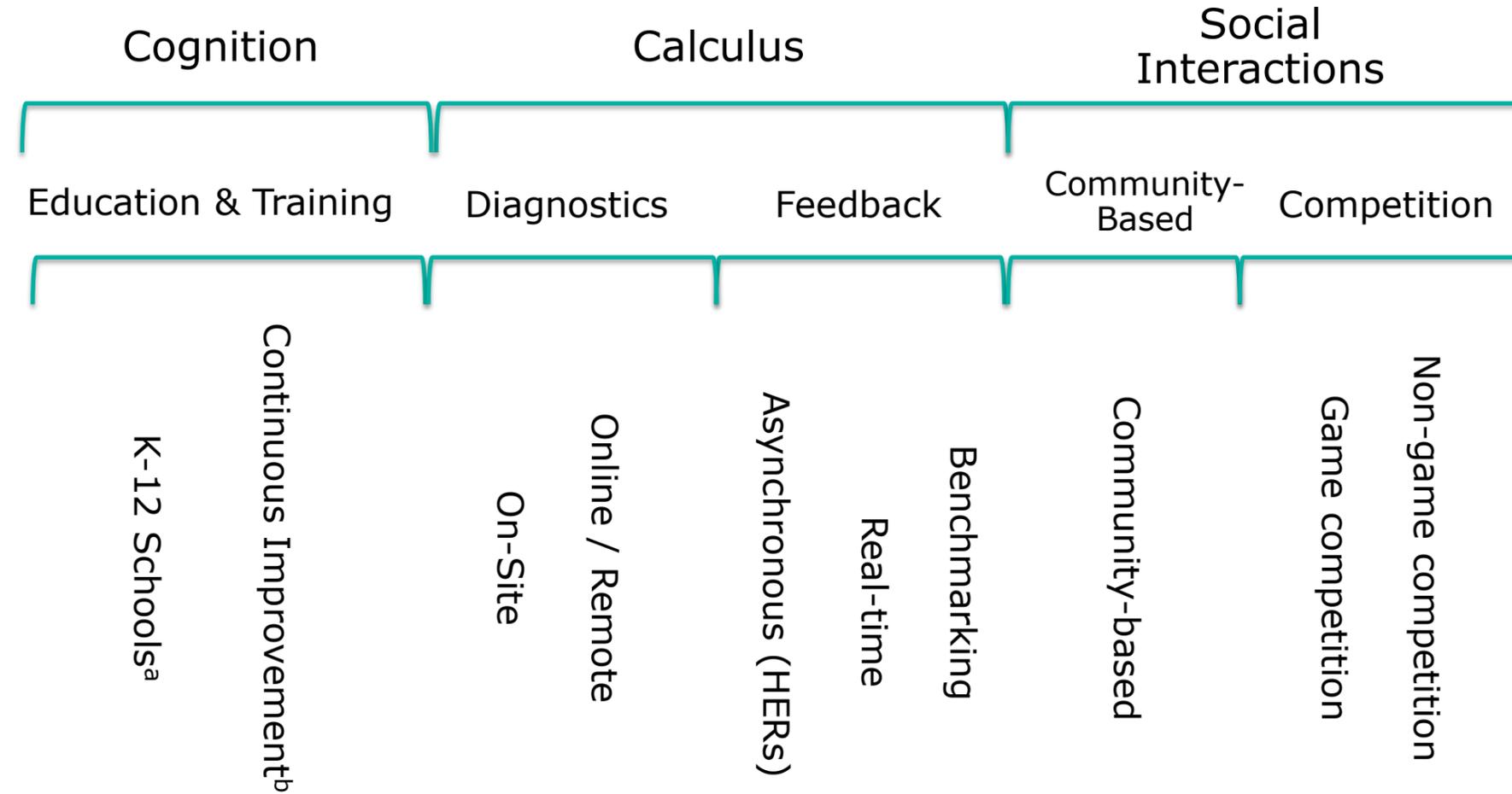
# Taxonomy of Behavioral Programs

**Family**

**Category**

**Program Classes**

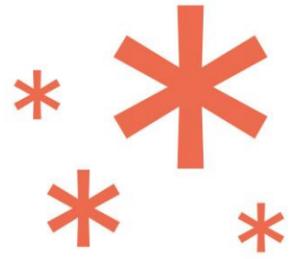
**Features**



- Opt-in/Opt-out
- Behavioral intervention tactics
- Target (e.g., small vs. large C&I)
- Program objective (e.g., energy savings vs. portfolio support)
- Funding source

<sup>a</sup> We consider K-12 Schools programs to be a “Commercial” offering based on where the program is delivered, though savings may be achieved in the school or student homes

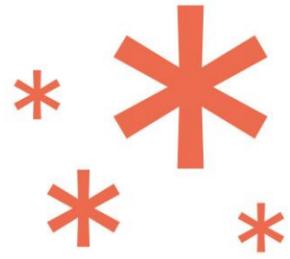
<sup>b</sup> Continuous Improvement (also known as Strategic Energy Management) is a commercial-only offering



We reviewed more than 170 studies, and excluded many programs for lack of comparable results

- Of these, 58 behavioral program models met our screening criteria and had evaluated energy savings (35 Residential and 23 Commercial)
- Many excluded due to lack of results that allow for comparisons
- This does not represent all eligible programs – in particular, we limited benchmarking of Home Energy Report programs
- In some program classes, due to lack of representatives, we included those evaluated less rigorously



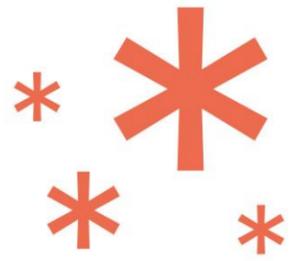


## Reported savings do not represent comparable actions

Savings for different program classes may measure different things

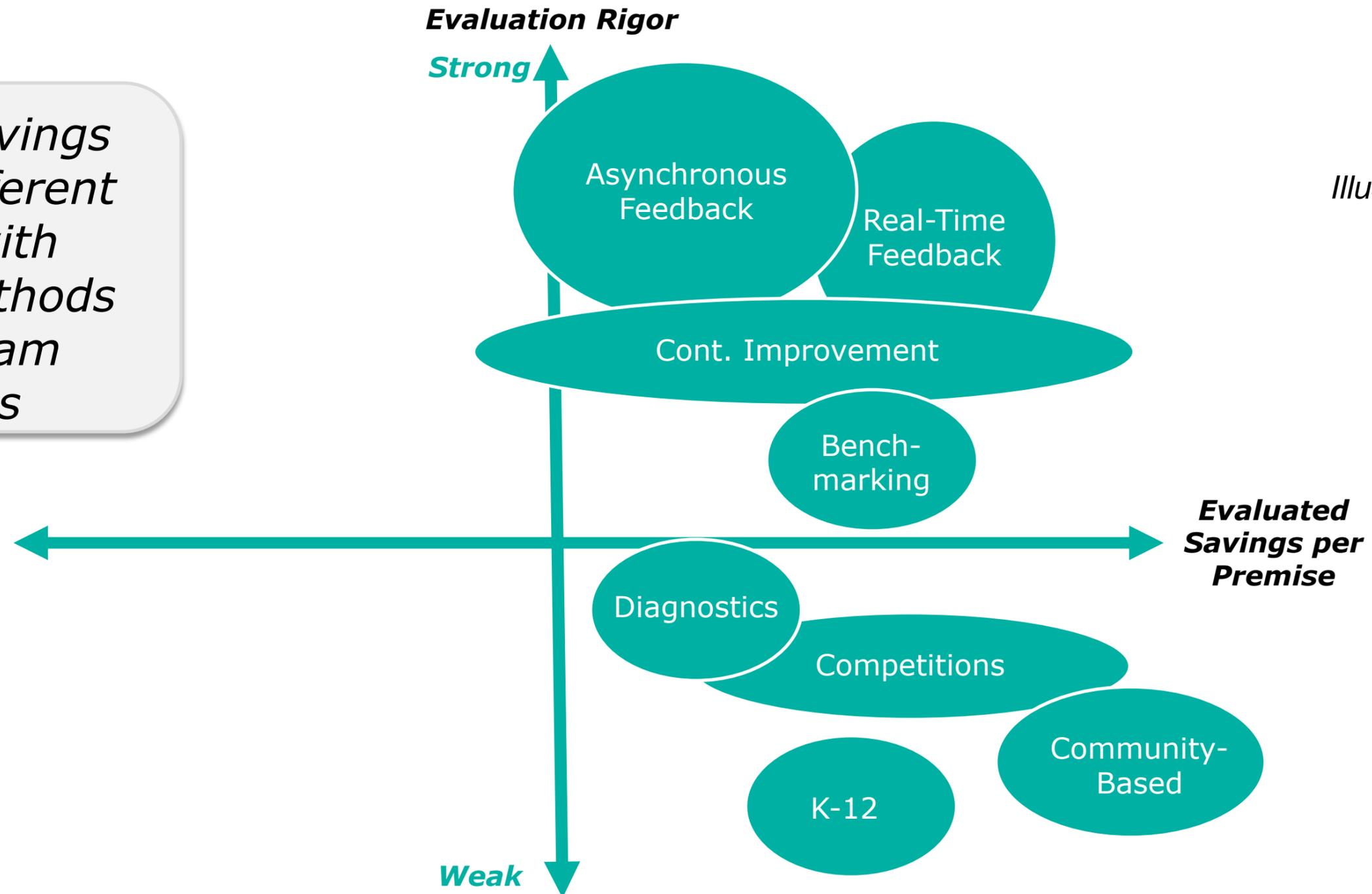
- **Gross, net, or net adjusted** savings (only HERs and SEM typically remove double-counted savings)
- **Duration** of program intervention and measurement (competitions/challenges are short-term only)
- **Actions** measured (e.g., community-based programs measure savings from direct install & weatherization)
- **Opt-in or opt-out** model





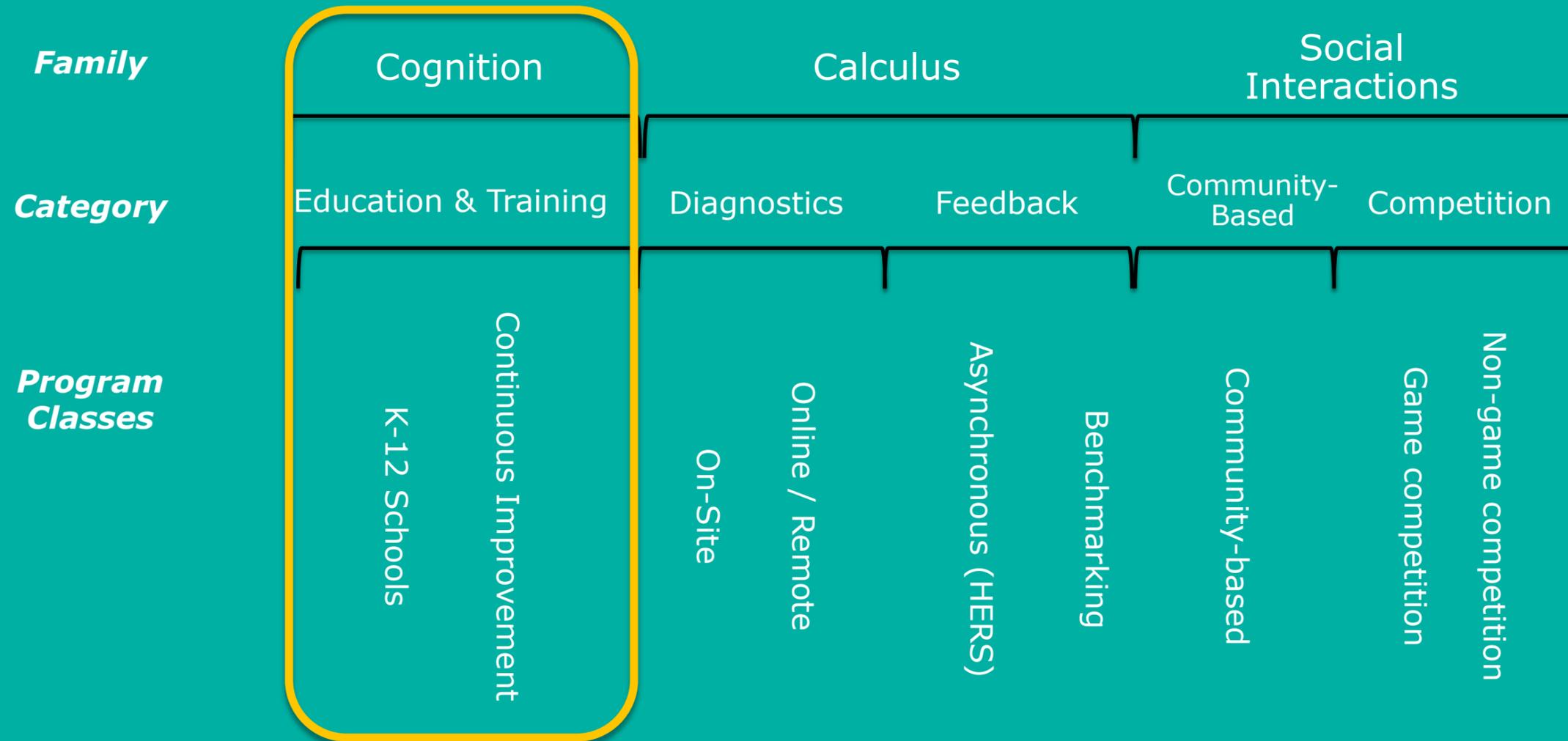
# Asynchronous Feedback Programs (e.g., HER programs) are the most rigorously evaluated

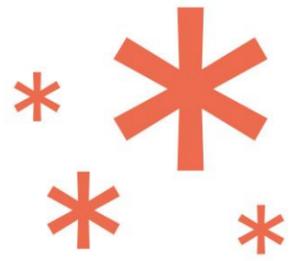
*CAVEAT: Savings measure different actions, with different methods and program durations*



*Placement is Illustrative – meant to reflect relative positioning*

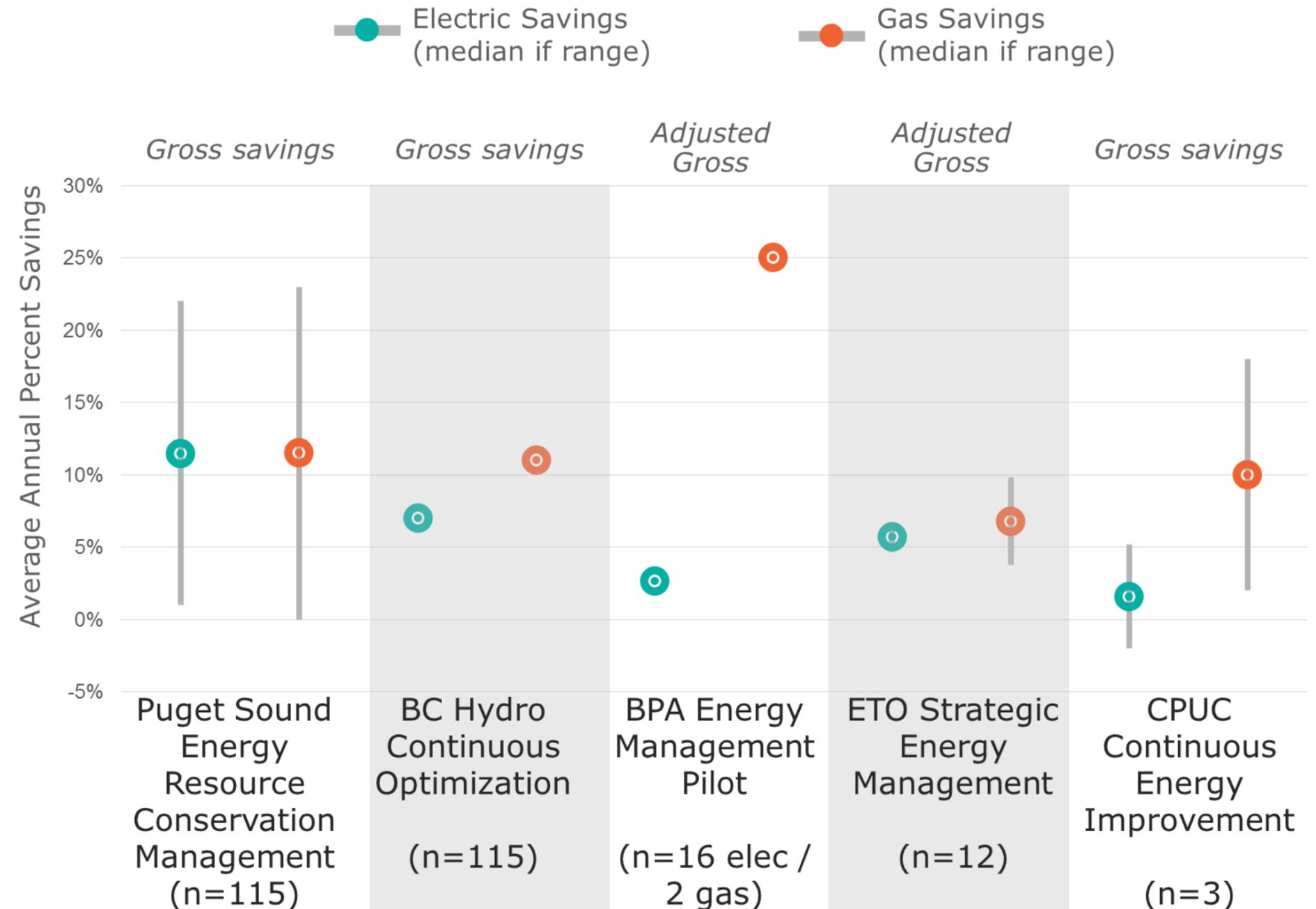
# COGNITION: EDUCATION & TRAINING

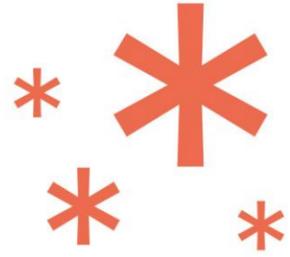




# Commercial **SEM** / **Continuous Energy Improvement** use multiple behavioral strategies

- Common tactics: Goal-setting, commitment, in-person interactions / training, feedback
- Typically measure **gross** or adjusted gross savings (removing double-counted savings)

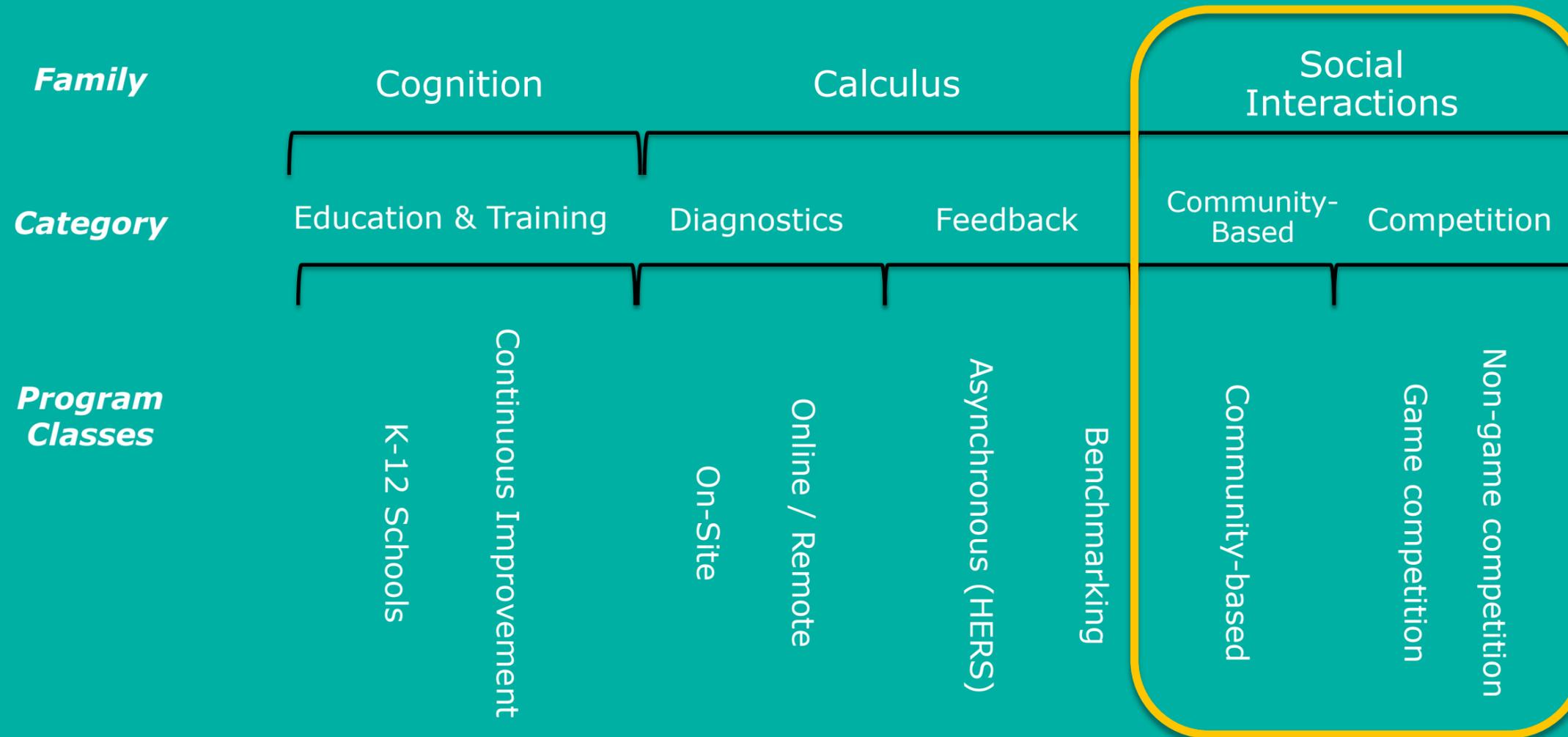


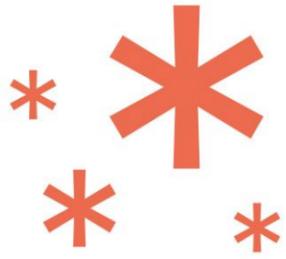


## **K-12 Education** programs do not typically evaluate savings in a meaningful way

- We reviewed two K-12 programs that use behavioral strategies, but only one had evaluated savings.
  - Many K-12 programs do not have evaluated savings, and as such, are not included in this analysis.
  - The one K-12 program with evaluated savings did not describe their evaluation approach.
- Of all Education and Training programs (including CIE and K-12 programs) reviewed, the following social science interventions are used, listed in order of their prevalence in programs: (1) training; (2) goal-setting; (3) commitment; (4) in-person interactions; and (5) feedback.

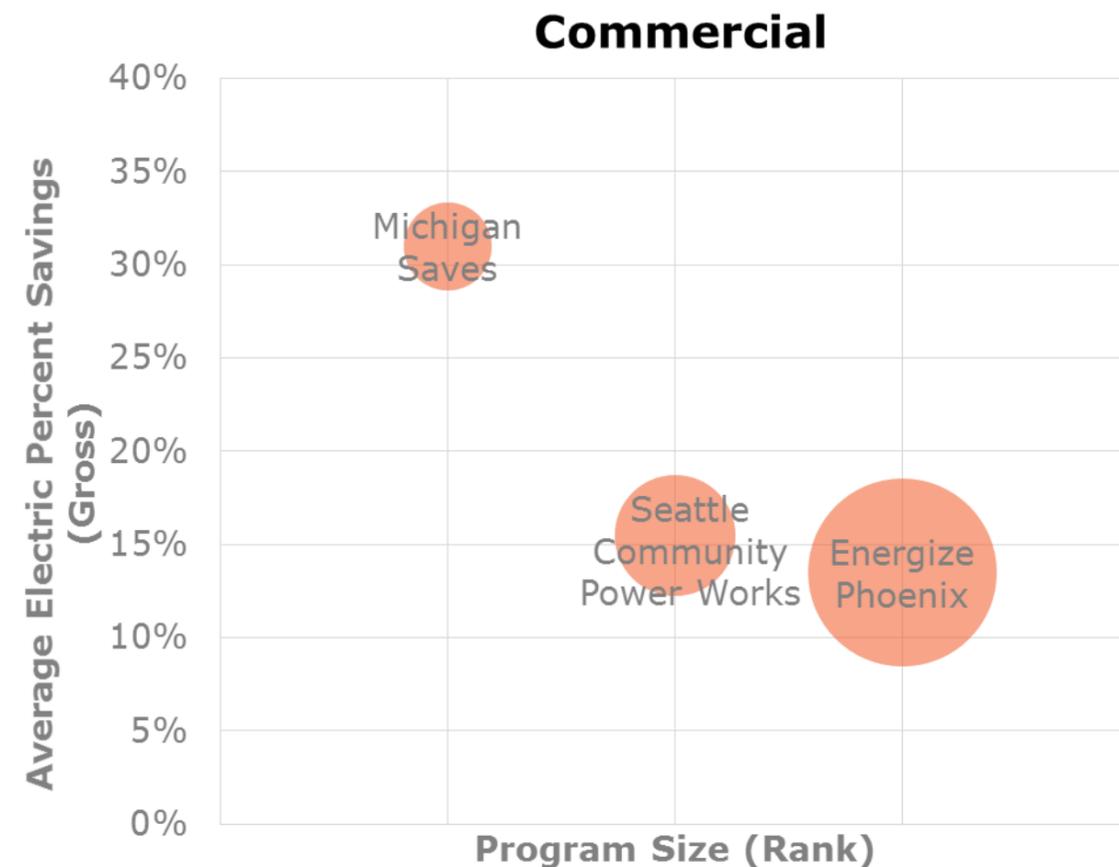
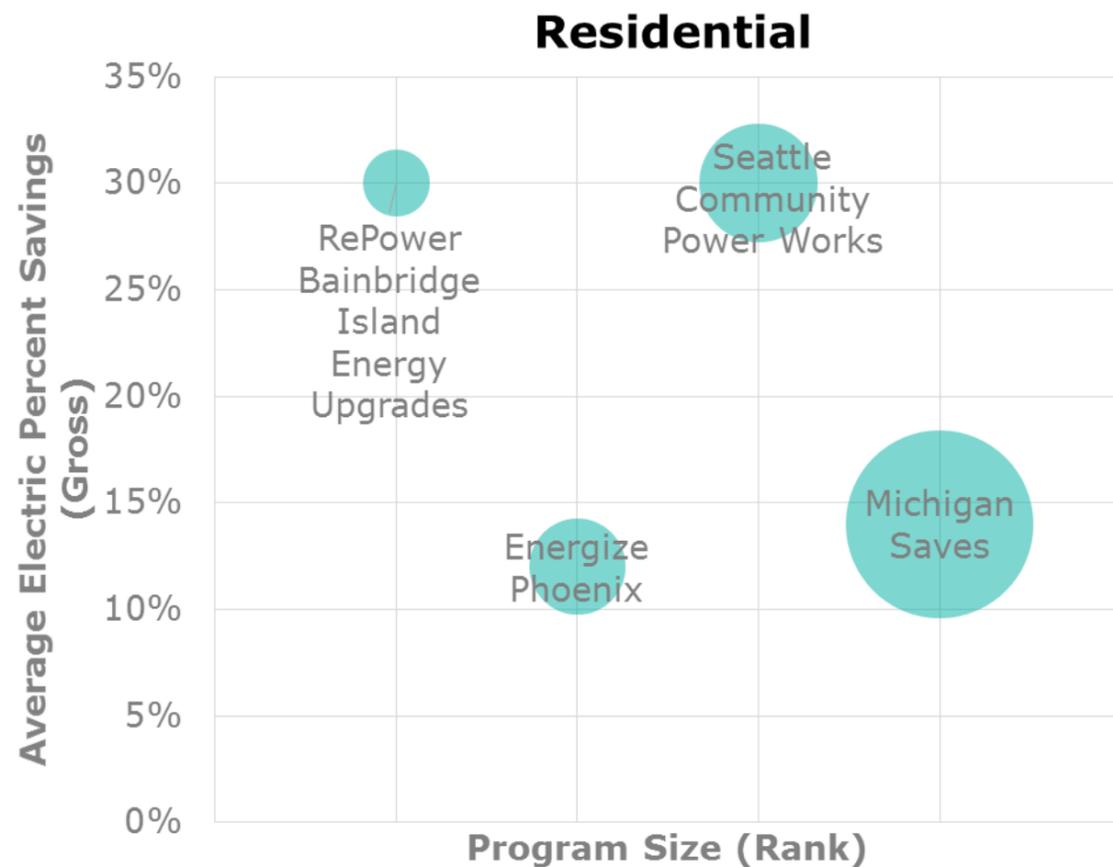
# SOCIAL INTERACTIONS: COMMUNITY-BASED





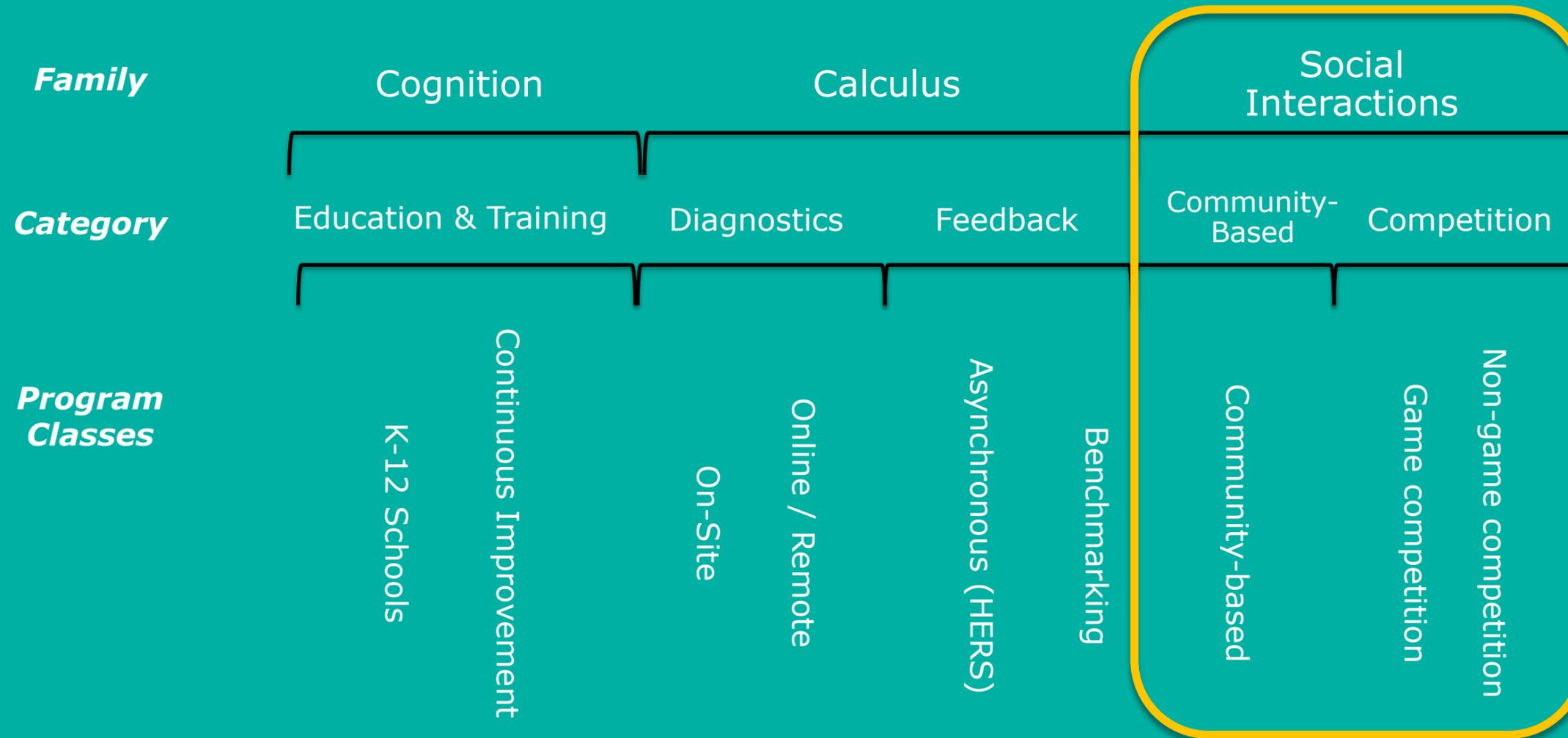
# Community-Based programs report *gross* savings from retrofits ranging from 12-30% (Residential) and 10-18% (Commercial)

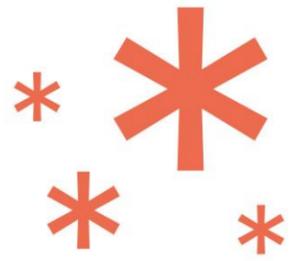
- Better Buildings Neighborhood Program (BBNP) and community-based program reports very rarely report per premise or percent savings
- When reported, values are gross, and typically reflect deemed savings through energy upgrade programs (primarily measures)



\*Gross savings associated with home energy upgrades or business energy upgrades, typically delivered through existing programs. As such, the savings estimates are based on first-year program-reported measure savings, typically estimated from building energy models (implementer software) or deemed savings.

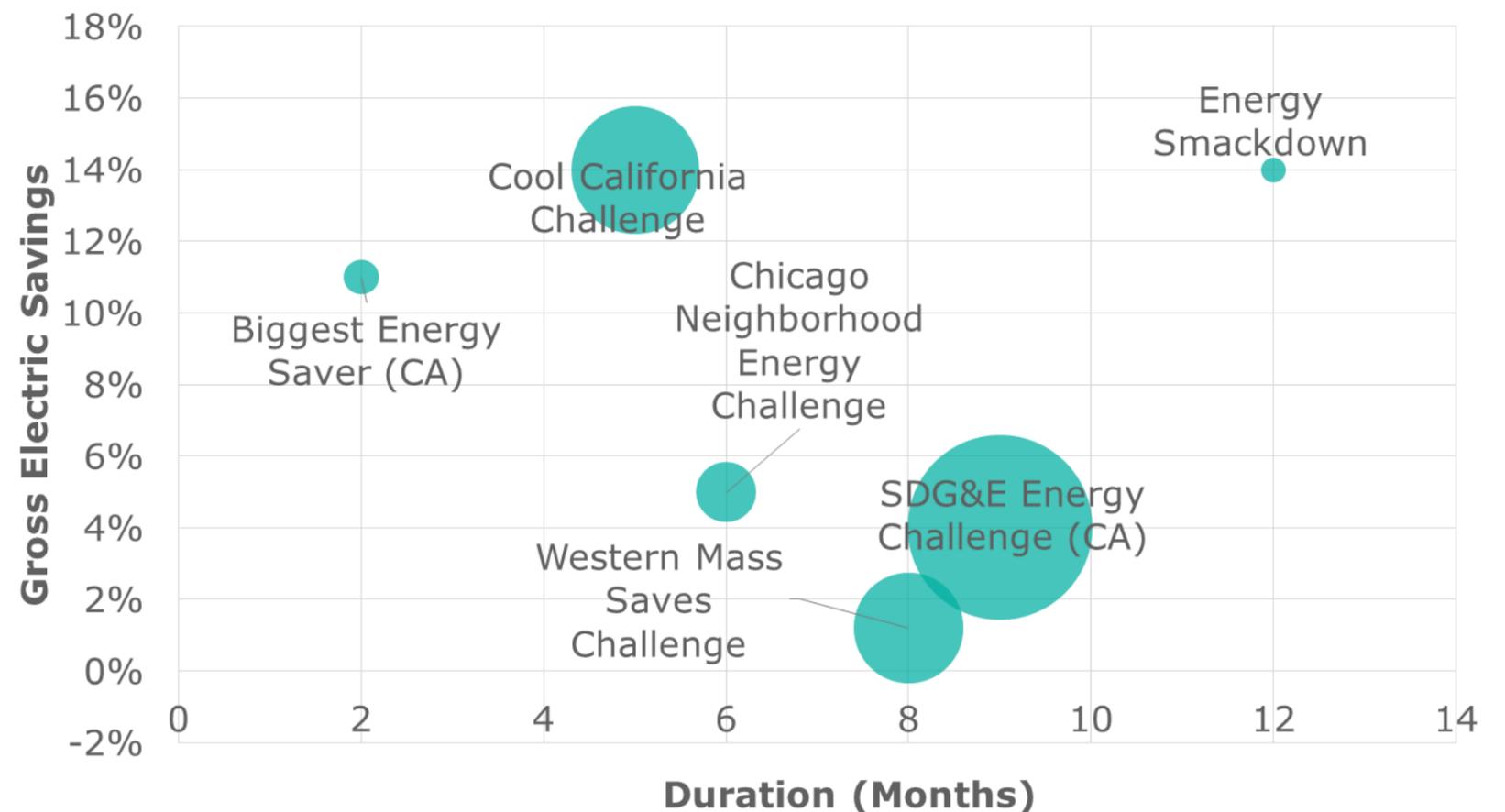
# SOCIAL INTERACTIONS: COMPETITION





## Residential competition programs seem to save in short-term but use inconsistent success metrics; present an opportunity for more rigorous evaluation

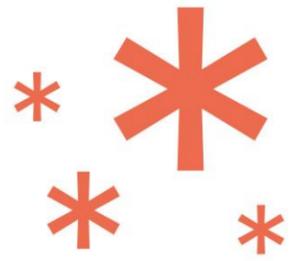
- Most common tactics: Community competition, social norms, feedback, peer-to-peer interactions, rewards
- Goal-setting occasionally used
- Savings appear high, but they are typically **gross savings**, and the program and evaluation period typically a **short duration**



*Bubble size is number of participants  
Select programs shown. See report for details of all programs included in study.*

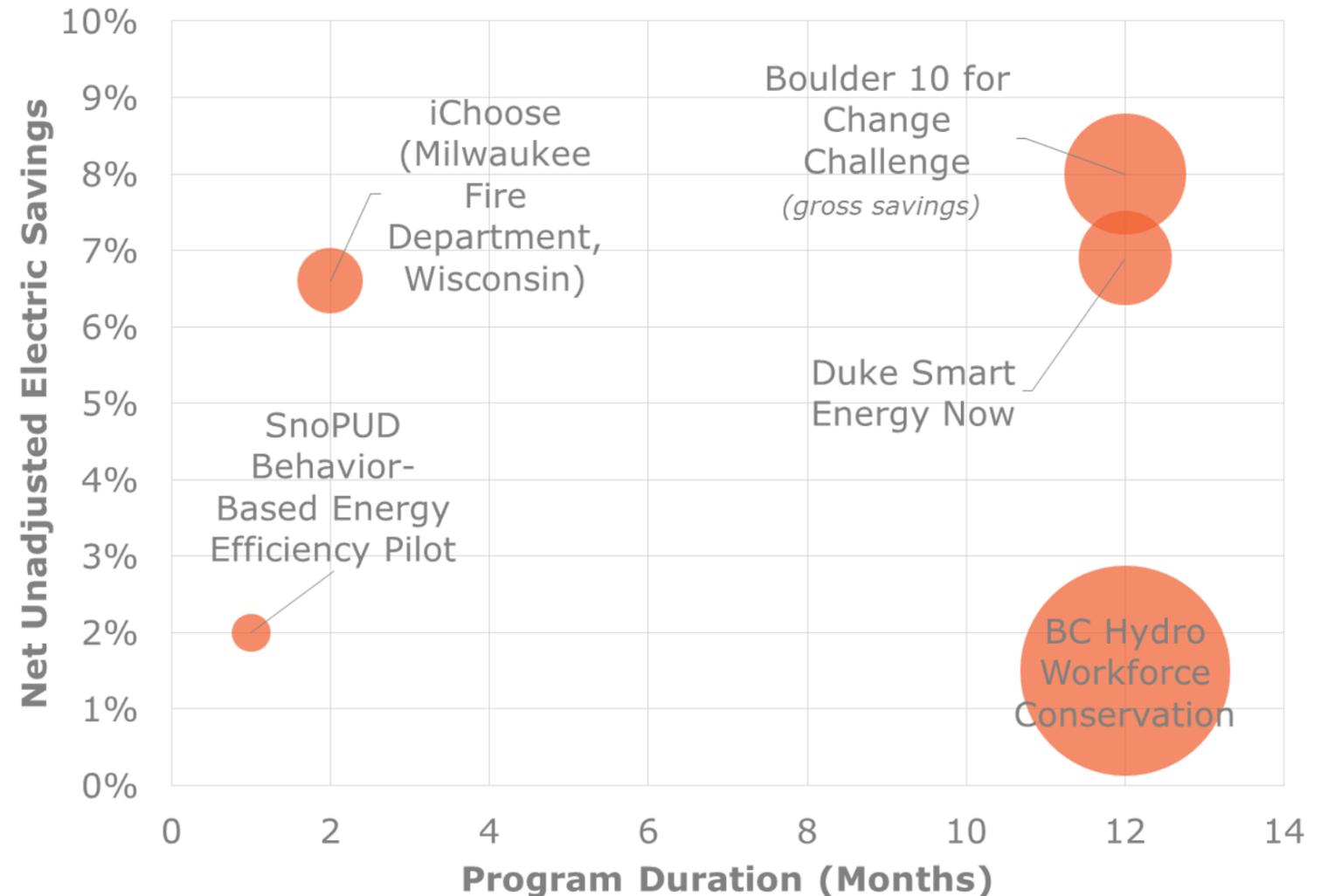
Vine, E., and Jones, C. (2015). *A review of energy reduction competitions studies: scaling up deeper savings through comparative feedback and recognition*. Prepared for California Public Utilities Commission. California Institute for Energy and Environment.

Grossberg, F., Wolfson, M., Mazur-Stommen, S., Farley, K., & Nadel, S. (2015). *Gamified Energy Efficiency Programs* (No. B1501). American Council for an Energy Efficient Economy. Retrieved from <http://www.aceee.org/research-report/b1501>



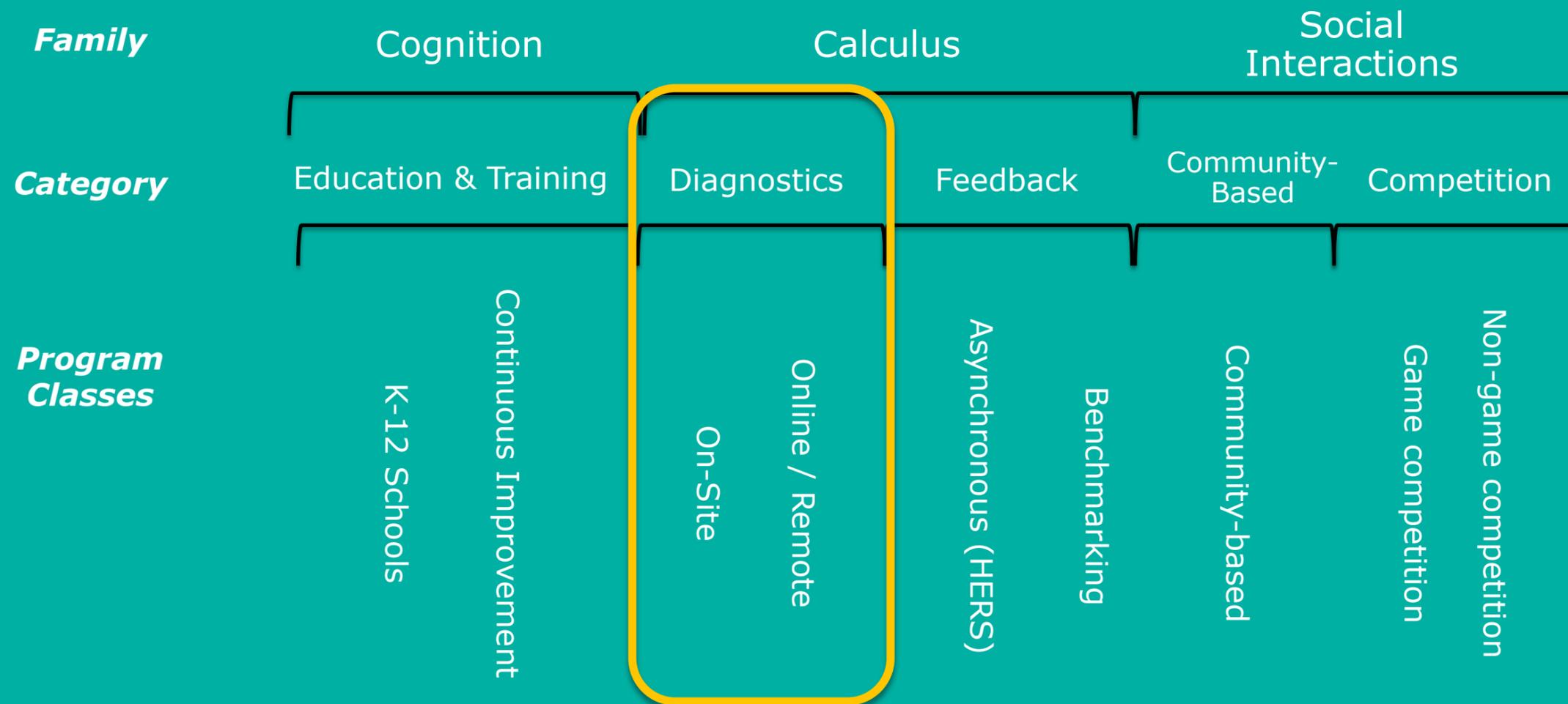
# Commercial Competition and employee engagement programs tend to have longer duration and more rigorous evaluation approaches

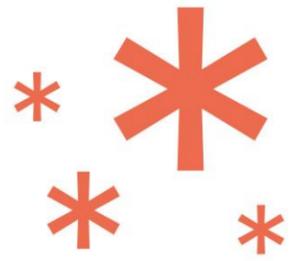
- Common tactics: Between-building competition, feedback, peer-to-peer interactions (incl. energy champions), rewards
- Goal-setting and commitment occasionally used
- Typically measure net savings (sometimes adjusting for rebate programs)



*Bubble size is number of participants  
Select programs shown. See report for details of all programs included in study.*

# CALCULUS: DIAGNOSTICS





Many **Diagnostic** programs we reviewed do not qualify as “behavioral”, while others have not been evaluated

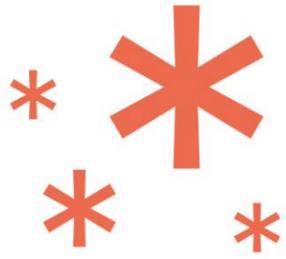
- Many diagnostic programs rely on in-person interactions with program staff, but these are not “peer to peer” or with a “trusted community member”
- More limited use of other behavioral strategies than expected

## Recommendations

Our recommendations to you cover major energy efficiency improvements for your home that will have the most impact. We do not account for other possible monetary and nonmonetary benefits to you such as increasing the property value of your home, extending the life of your air conditioner and heater, and an overall increase in home comfort. The only items we address below are those items which received a “Low” or “Below Average” rating. We have also included any specific items you have requested.

Payback less than 10 years	Estimated Cost*	Annual Savings	10 Year Savings**	Payback**
We Recommend: AC Tune Up (2)	\$140	\$201	\$2,528	0.7
We Recommend: Upgrade to Compact Florence	\$226	\$201	\$2,843	1.1
We Recommend: Seal Your Ventilation Ducts				3.7
We Recommend: Radiant Barrier	\$957		6	7.6
We Recommend: Attic Tent	\$195	\$19	\$239	8.5
We Recommend:				

*example of typical audit report*



# Audit reports present an opportunity to utilize framing techniques, choice architecture, and display norms

...But we did not find clear examples of this among *evaluated* programs

**SEPTEMBER 2013**  
**6**  
 eScore™  
 energyright solutions

**SCORE CARD**

Category	eScore
Air Sealing	4
Attic Insulation	5
Duct System	3
Lighting	4
Heating / Cooling Systems	6
Appliances / Electronics	5
Water Heating	7
Refrigerator	8
Windows & Doors	4
Wall Insulation	10

09/14/13 eScore™ 6

**\$163 OR 7¢**  
 SQUARE FOOT  
 Your Home's MONTHLY AVERAGE Energy Cost

Wasting More Energy 1 2 3 4 5 6 7 8 9 10 Saving More Energy

Your Home Now (6) Your Home's Best (10)

**YOUR HOME CAN BE A 10**  
 Make your home as energy efficient as possible. Complete the list of energy upgrades on the back of this card and your home will score a 10. Turn the page and start saving!

**10** FOR **20%**

Average Valley Homes that achieve a 10 can expect up to 20% savings on energy costs.

**YOUR PATH TO A 10**

Upgrade	09/14/13 eScore	INSTANT REBATE
<b>Air Sealing:</b> Stay cool in summer and warm in winter by closing the places where air leaks in or out	4	\$
<b>Attic Insulation:</b> Keep warm or cool air from escaping through your roof by adding more attic insulation	5	\$
<b>Duct System:</b> Close the gaps in your ducts to get the most for your energy dollars	3	\$
<b>Lighting:</b> Replace your old incandescent bulbs with energy saving CFL or LED bulbs	4	
<b>Heating / Cooling Systems:</b> When your old system needs replacing, buy equipment that meets the ENERGY STAR® standard	6	\$
<b>Appliances / Electronics:</b> Replace old appliances and electronics with ENERGY STAR® certified equipment	5	
<b>Water Heating:</b> Lower your water heating costs by installing a super-efficient ENERGY STAR® certified unit	7	\$
<b>Refrigerator:</b> Replace your old refrigerator with an ENERGY STAR® certified model and save up to 30%	8	
<b>Windows &amp; Doors:</b> Look for the ENERGY STAR® label when replacing your doors or windows	4	\$
<b>Wall Insulation:</b> When remodeling your home, add insulation to your walls for more comfort and higher energy savings	10	

Complete these first 3 upgrades and you can raise your score to a 7.

**7**  
 eScore™

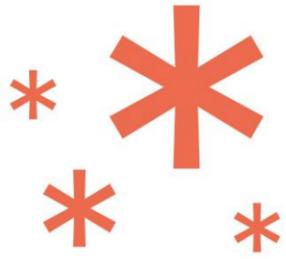
**HOMEOWNER**  
 Nielsen Residence  
 5217 Walnut Grove Rd  
 Memphis, TN 38120

**ADVISOR**  
 Memphis Light, Gas and Water  
 Completed: 09/14/13  
 Energy Advisor: Mark Scheffeld  
 1.800.555.5555

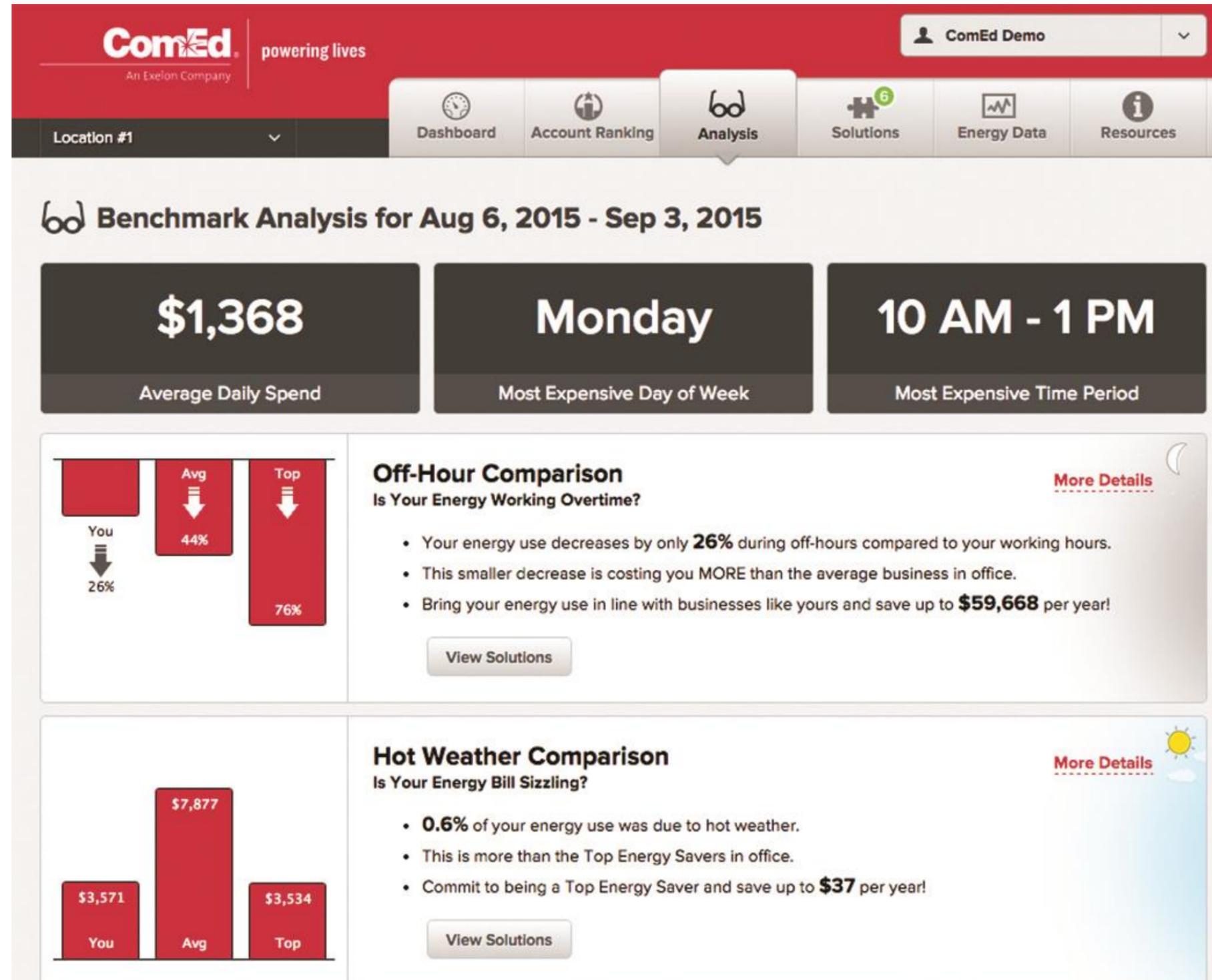
**MLGW**

**GREAT JOB – FINISHED PROJECTS**

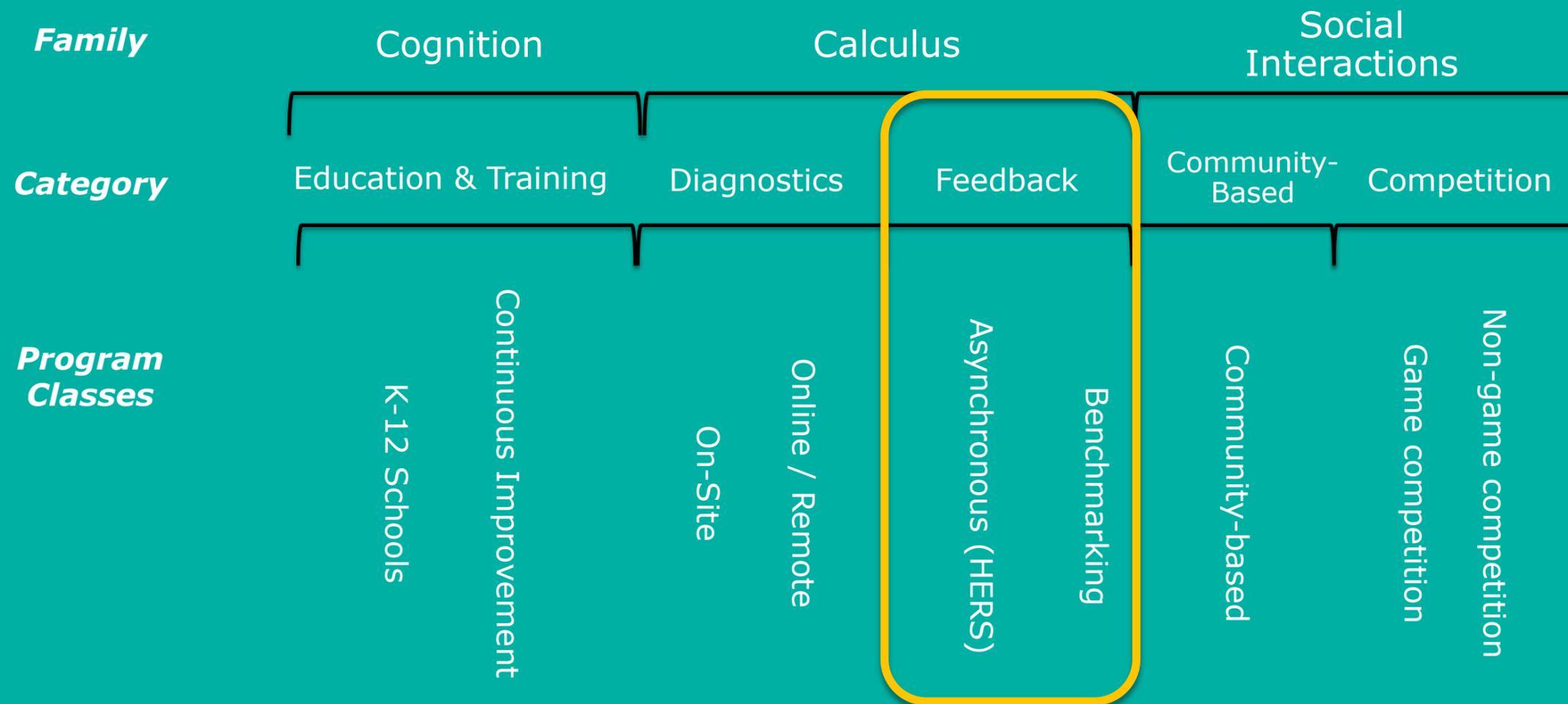
<http://www.cemc.org/escore.asp>

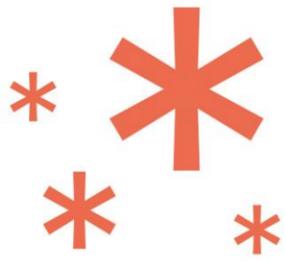


Emerging class of online diagnostics programs has not been evaluated yet (and may not be)

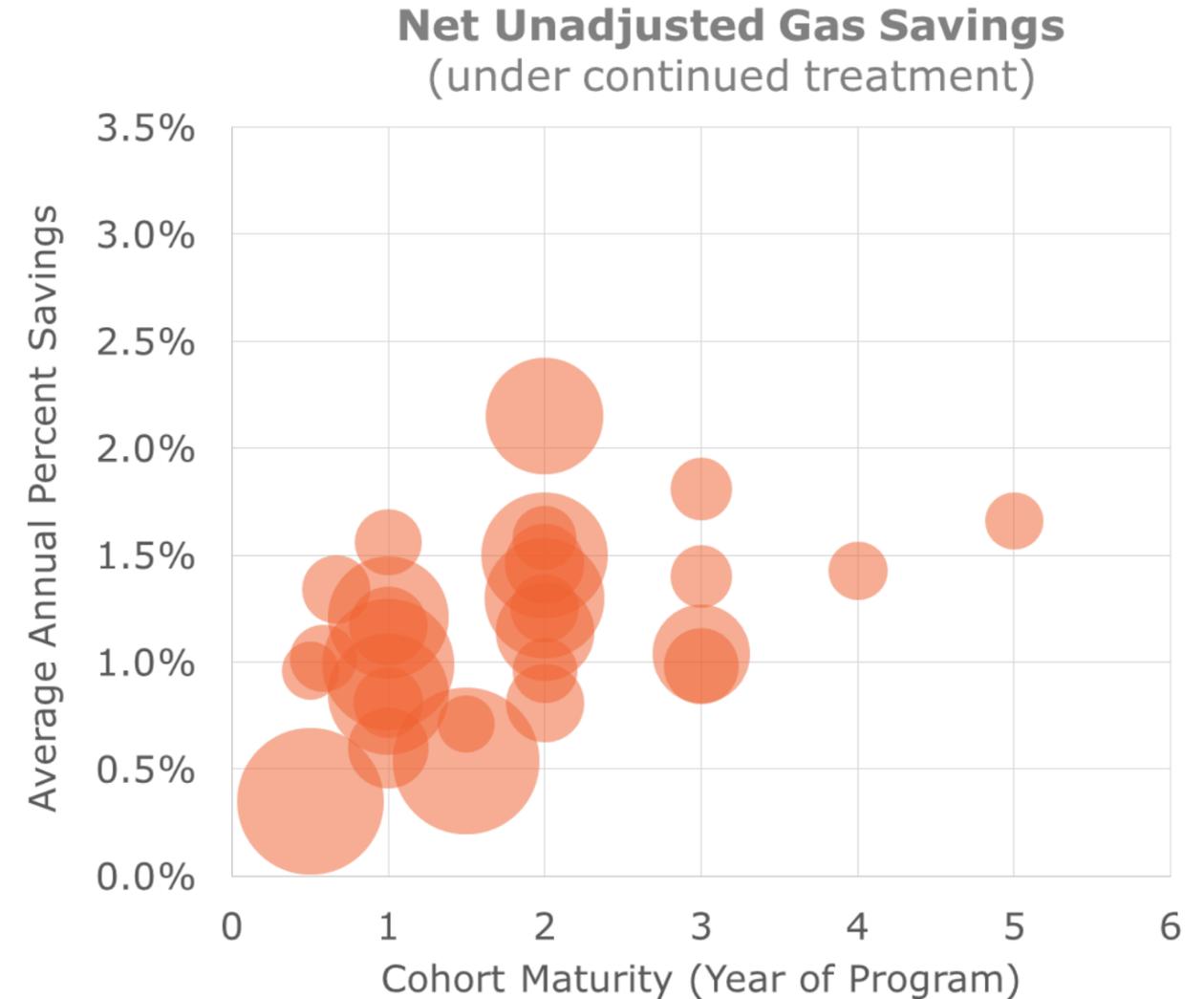
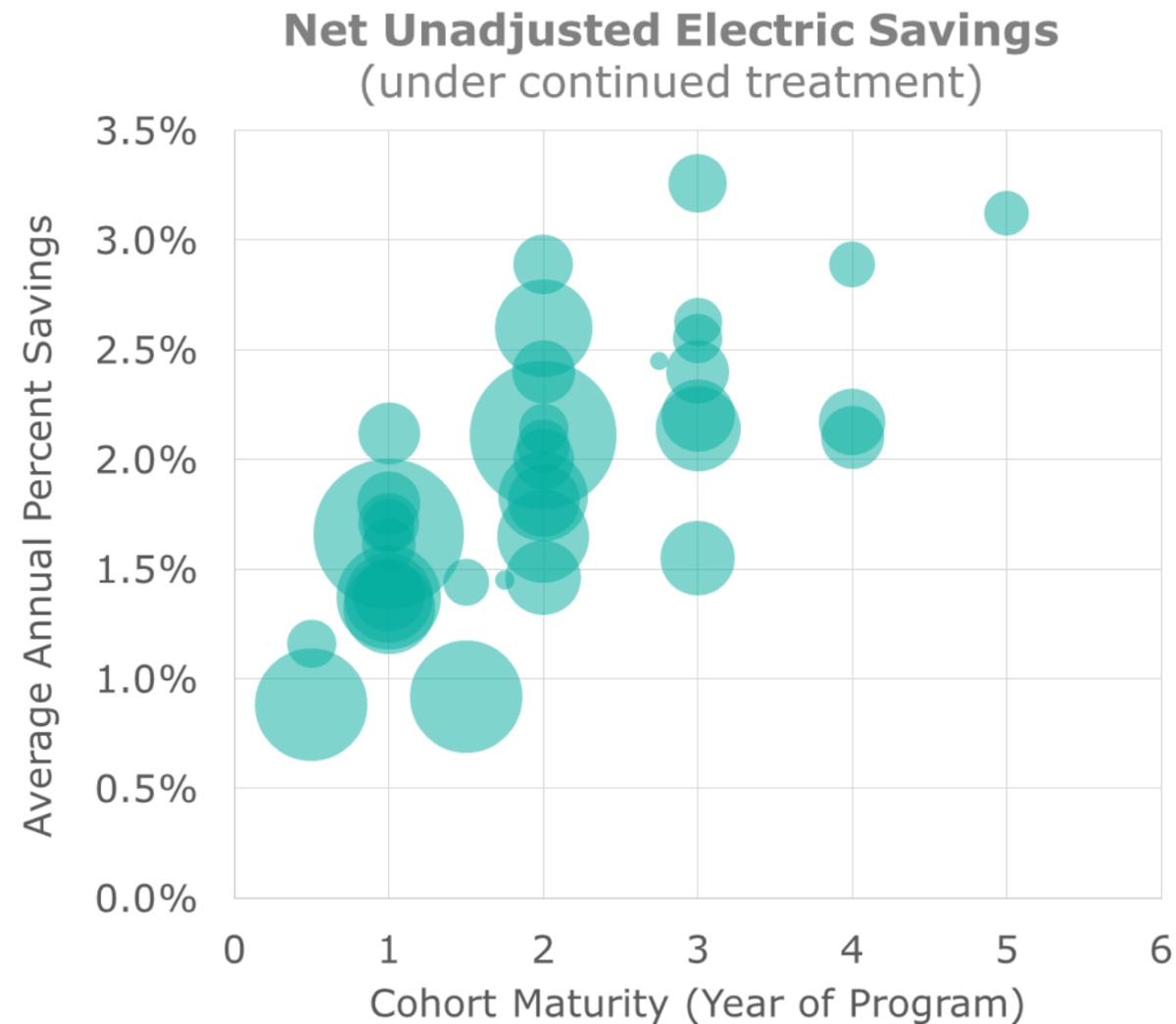


# CALCULUS: FEEDBACK

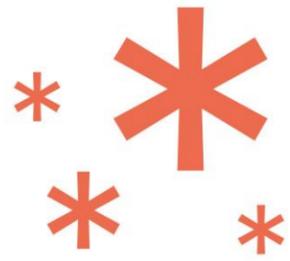




# Residential **Asynchronous Feedback** programs: Savings generally increase after the first year, under continued treatment

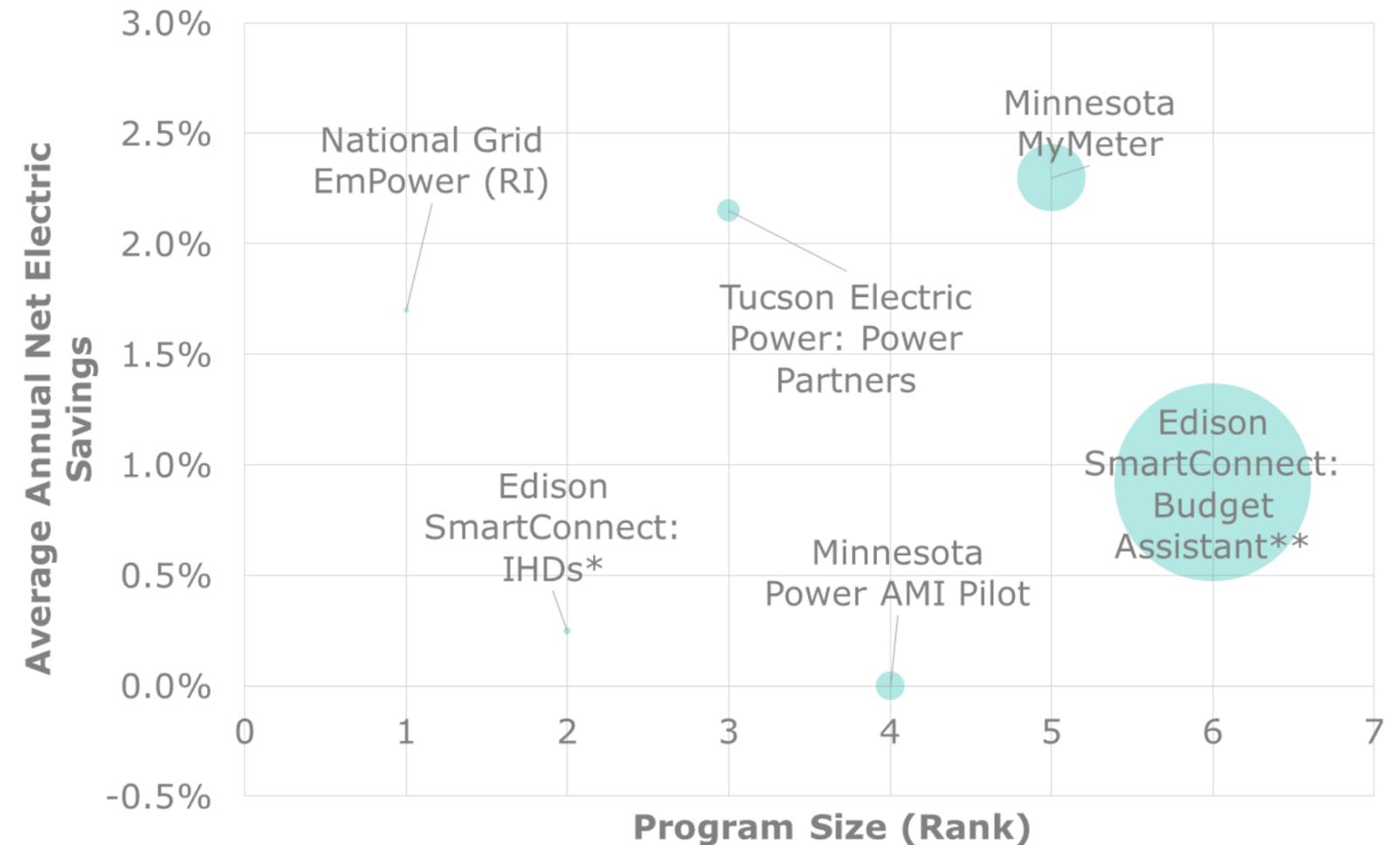


*Bubble size corresponds to program participation for one cohort of a program.*



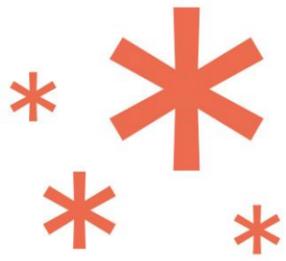
Residential **Real-Time Feedback** programs, without pricing, report net electric savings ranging from 0%-3.1%

- Primary strategies are **feedback (via online portal or IHD; energy use and notifications), goal-setting, recommendations, and competitions**
- Savings shown are **net and unadjusted** for double-counting
- Savings not always measured for full year – for two of these programs, savings peaked in first 1-3 months, then declined
- Typically evaluated with matched comparison (though Random Encouragement Design is recommended)



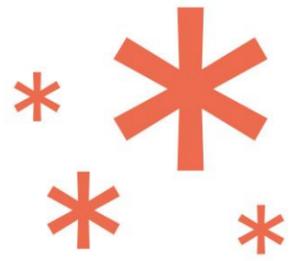
\*3% savings in first 30 days and 0% thereafter

\*\* Savings start at 0.92% but diminish over the first year



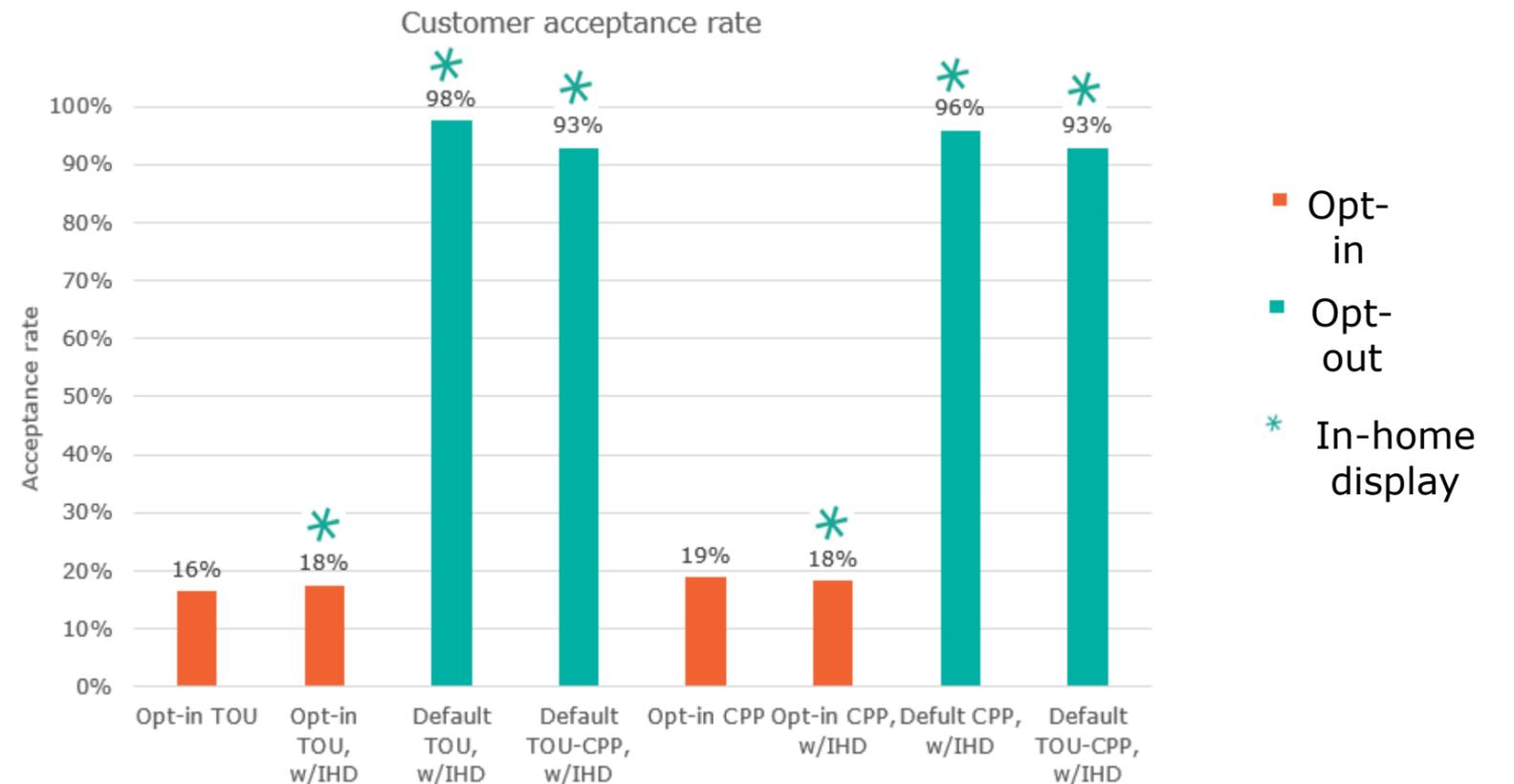
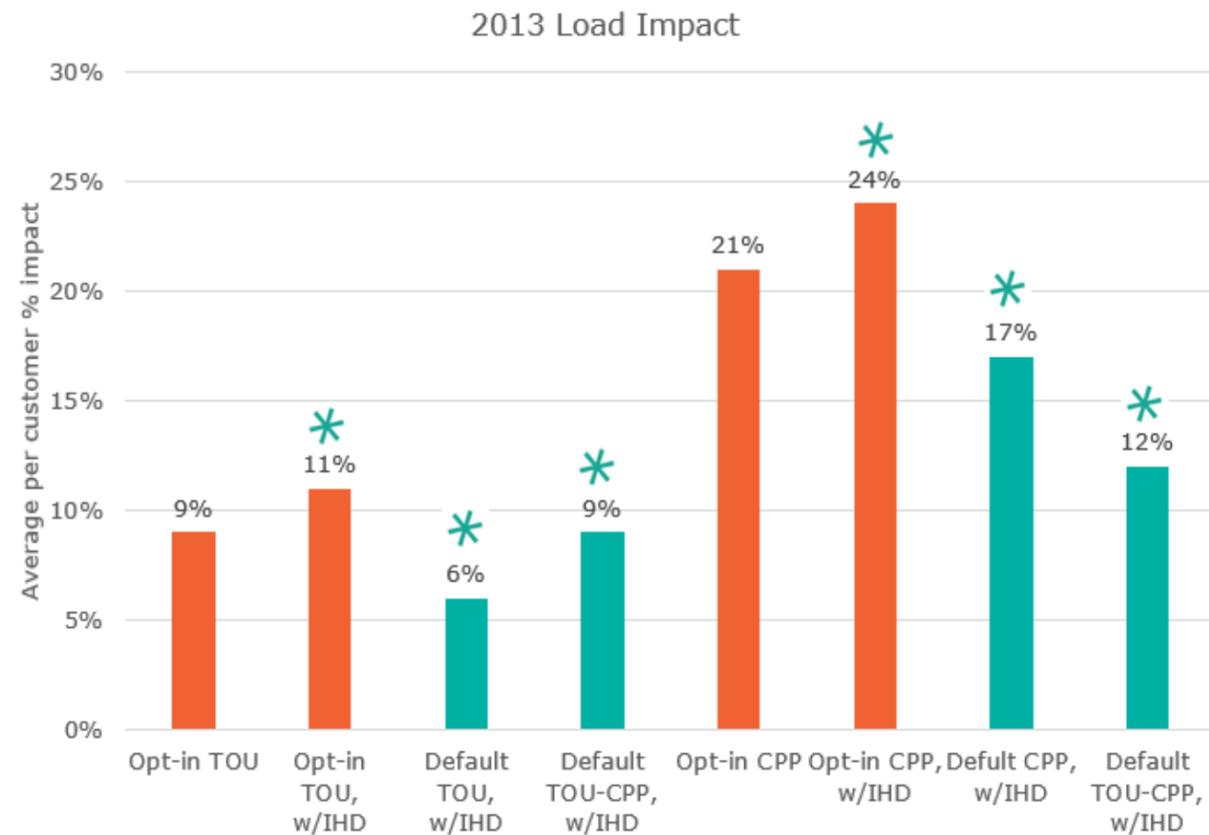
Residential **Real-Time Pricing** programs report summer peak reduction ranging from 8%-26%

- Few RTP programs met our definition, because we didn't consider pricing ALONE to be social-science-based
  - Many RTP programs only provide feedback/information on costs without coupling that feedback with other tools such as social norms, goal-setting/commitment, rewards, etc.
- Only catalogued two programs:
  - Edison SmartConnect IHD program (feedback via IHD), which saved about 6% in the first 60 days but then declined to 0
  - SMUD's SmartPricing Options pilot (with feedback via web portal and IHD) - *next slide*

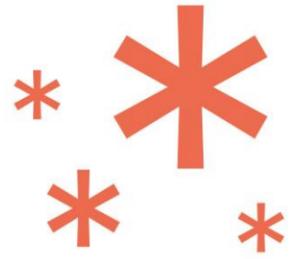


# SMUD Opt-in vs. Opt-out Smart Pricing Options

- In this study average per participant savings is higher for opt-in customers (orange bars)
- However, the acceptance rate for opt-out customers is greater, so the overall savings potential is higher for the opt-out design

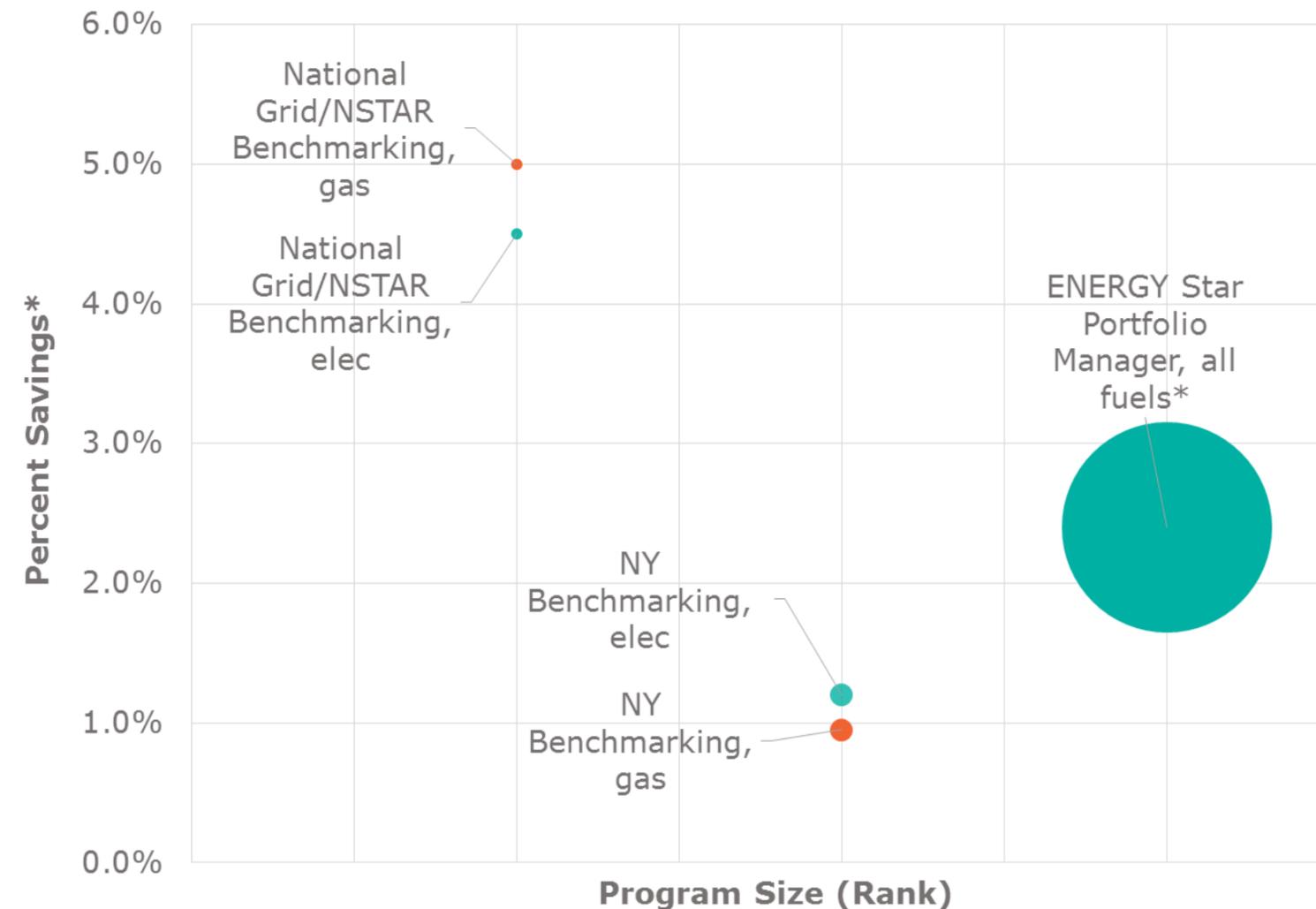


Nexant. (2014). *Load Impacts and Customer Choice Results from SMUD's Two-Year Smart Pricing Options Pilot*. Presented at the National Town Meeting on Demand Response and Smart Grid.



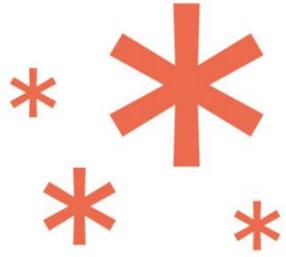
# Commercial **Benchmarking** programs generate Savings from 1.1-5% (Electric) and 0-7% (Gas)

- EnergyStar Portfolio Manager very widespread
- Few program administrators have independently evaluated savings
- Savings can stem from multiple actions, including measures



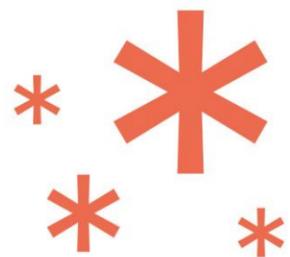
\*Savings are average annual net unadjusted savings, except for Energy Star Portfolio manager, which are average annual gross savings.

# CONCLUSIONS



# Program and Portfolio Recommendations

- Feedback family may be best-suited to EE resource standard program models, though persistence research is still lacking for some opt-in models
- Social interactions programs, especially competitions, may have great potential in generating **short-term savings**, but need to be more rigorously evaluated
  - These approaches spark interest and engagement and could be paired with traditional programs
- Cognition programs such as SEM may be effective due to multi-pronged strategies, but may be costly to implement due to “high-touch” interactions
- Many existing programs still present an opportunity to utilize more behavioral strategies (e.g., go beyond feedback)
- Consider ways to use behavior programs as channeling mechanisms



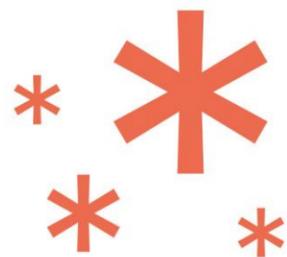
## Evaluability and comparability limits benchmarking – consider reporting standard metrics

### Opt-in programs

- Inputs to participation rate and/or marketing response rate (e.g., marketed n)
- Targeting criteria
- Participant n
- Average baseline consumption of enrolled participants
- Average savings per premise
- Percent savings (vs. comparison or baseline; specify)
- Savings duration
- Any adjustments made to savings (e.g., double-counting)

### Opt-out programs

- Percent and per-premise savings commonly reported
- Could improve reporting of targeting criteria



## Resources

### **SEE Action Webinar Series**

- |        |  |        |
|--------|--|--------|
| Oct 27 | SEE Action:<br>Isn't it all behavior change anyway?                    | 2pm ET |
| Nov 3  | SEE Action:<br>Benchmarking Behavioral Programs on Savings and Impacts | 2pm ET |
| Dec 2  | SEE Action:<br>Behavior Change Strategies in Traditional EE Programs   | 2pm ET |

### **Minnesota CARD Benchmarking Report**

<https://mn.gov/commerce/energy/images/energy-efficiency-behavioral-programs.pdf>

*or Google:* Minnesota CARD behavioral benchmarking

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