



Energy Technologies Area

Lawrence Berkeley National Laboratory

# What Does It Cost to Save a Therm?

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This work was supported by the U.S. Department of Energy's Building Technologies Office.

# Webinar Housekeeping Items

- ◆ The report and webinar slides are posted [here](#).
- ◆ We're recording the webinar and will post it on our web site.
- ◆ Because of the large number of participants, everyone is in listen mode only.
- ◆ Please use the **Q&A box** to send us your questions and comments any time during the webinar.
- ◆ Moderated Q&A will follow our presentation. We'll answer as many questions as we can at that time.

# What is the Cost of Saving Energy and why is it important?

## ◆ Cost of Saving Energy (CSE) is:

- ❑ The cost of achieving energy savings over the estimated lifetime of the efficiency measures (programs) implemented
- ❑ Reported in dollars per unit of energy saved (e.g., \$/therm)
  - Program Administrator (PA) CSE accounts for expenditures for planning, administering, designing, implementing, and verifying programs as well as providing financial incentives to consumers (and others)

## ◆ Why it's important

- ❑ State public utility commissions, utilities and other PAs use CSE data to:
  - Assess energy savings potential and design
  - Determine what programs to offer customers
  - Implement programs in a cost-effective manner
  - Accurately assess efficiency cost performance to ensure reliability most affordably

# Berkeley Lab Studies on Cost of Saving Energy

- ◆ Program typology ([2013](#))
- ◆ First study on program administrator cost of saving energy ([2014](#))
  - ▣ For both natural gas and electric investor-owned utilities (IOUs)
  - ▣ Cost to utility or third-party administrator (not including any participant contributions)
  - ▣ Analysis down to program level
- ◆ Updated analysis for electricity ([2015](#)), including *total* cost
  - ▣ Total cost = PA cost + participant contributions
- ◆ Most recent electricity analyses for IOUs
  - ▣ 116 PAs in 41 states, 2009-2015 ([2018](#))
  - ▣ Cost of saving peak demand, 9 states, 2014-2017 ([2019](#)) — expanded analysis underway
- ◆ Analysis for publicly owned electric utilities with APPA ([2019](#))
  - ▣ 111 PAs, representing 219 utilities in 14 states, 2012-2017
  - ▣ Analysis at market-sector level
- ◆ New study on cost of saving natural gas ([2020](#))

<https://emp.lbl.gov/projects/what-it-costs-save-energy>

# Context

- ◆ National average retail price of natural gas during our study period (2012-2017) was ~\$1/therm<sup>1</sup>
  - ▣ Retail prices include the commodity cost as well as transportation, delivery and storage costs. Some jurisdictions also include avoided environmental costs and avoided gas price risks.
- ◆ As another point of comparison, the average citygate (wholesale) price during this period was about \$0.45/therm.<sup>2</sup>
- ◆ U.S. households and businesses spent approximately \$65 billion on utility-supplied natural gas in 2018.<sup>3</sup>
- ◆ U.S. natural gas utilities spend about \$1.3 billion a year on energy efficiency programs.<sup>4</sup>

<sup>1</sup> [U.S. Energy Information Administration](#)

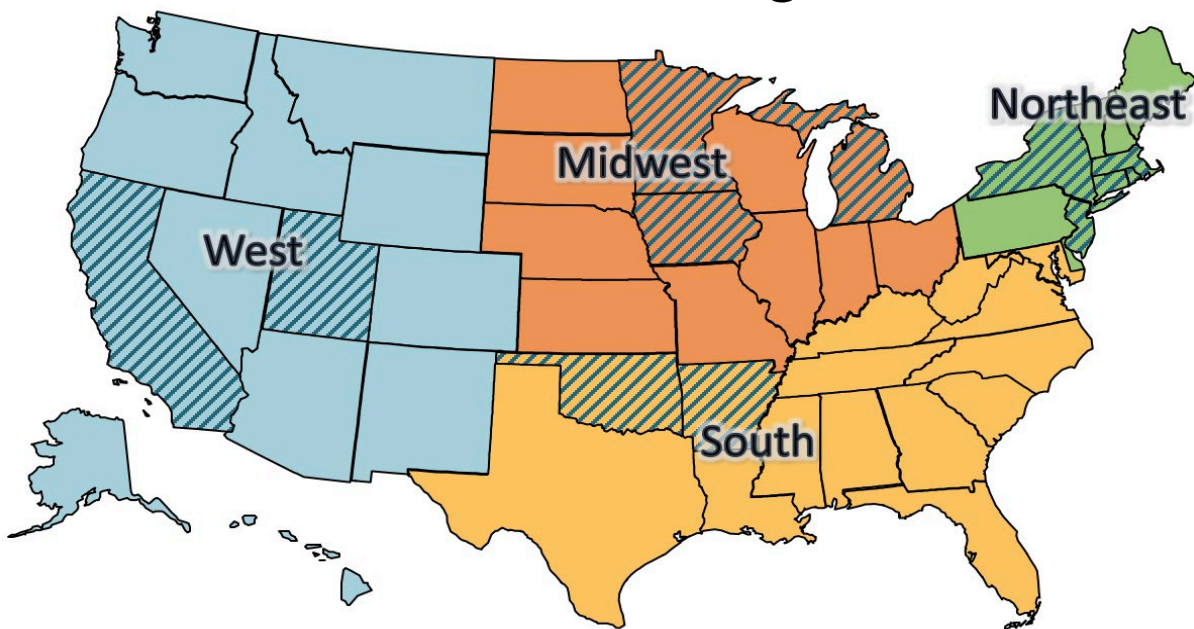
<sup>2</sup> [U.S. Energy Information Administration](#)

<sup>3</sup> [American Gas Association](#)

<sup>4</sup> <https://library.cee1.org/content/2018-cee-annual-industry-report/>

# Study Scope

- ◆ 37 program administrators from 12 states: AR, CA, CT, IA, MA, MI, MN, NJ, NY, OK, RI and UT
  - ▣ Account for ~50% to 70% of annual national spending on natural gas efficiency programs\*
- ◆ Representation in all four U.S. census regions
- ◆ Portfolio and market sector spending and savings
- ◆ 2012-2017



\*Based on national spending on programs as reported by the Consortium for Energy Efficiency.



Natural Gas PA CSE Data Collected

# Definition: PA Cost of Saving Gas

Levelized Program  
Administrator Cost of Saving  
Gas (PA CSE)

The cost to the *program administrator* for achieving gas savings over the economic lifetime of the actions taken, discounted back to when the costs were paid and the actions occurred

Assumptions and inputs:

- 6% discount rate (real)
- Estimated program average measure lifetimes
- Total program cost (not including participant contributions), including incentives (2017\$)
- Gross annual therms saved

***Program Administrator Cost of Saving Gas =***

$$\frac{\text{Capital Recovery Factor} * (\text{Program Administrator Costs})}{\text{Annual Gas Savings (in therms)}}$$

$$CRF = \frac{r(1+r)^N}{(1+r)^N - 1}$$

$r$  = the discount rate

$N$  = estimated program lifetime in years and calculated as the savings-weighted lifetime of measures or actions installed by participating customers in a program

# Scale of Efficiency Investments in Our Sample

Our sample represents about \$5B of spending and nearly 1.4B therms of energy savings during the study period: 2012-2017.

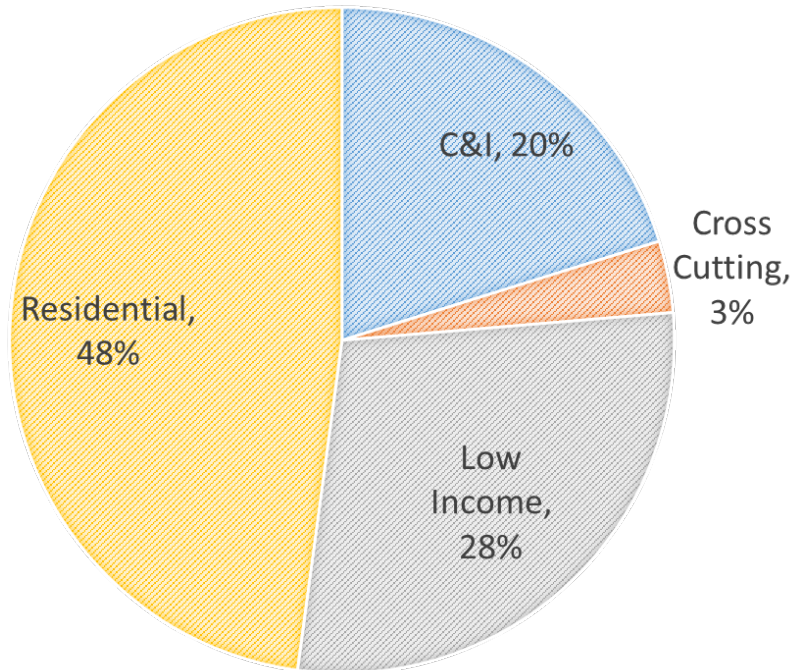
Sector	Annual Gross Savings (millions of therms)	Spending (\$2017 million)	Average PA CSE (\$2017)	Median PA CSE (\$2017)
Residential	587.3	\$2,283.7	\$0.43	\$0.40
C&I	598.1	\$989.6	\$0.18	\$0.24
Low Income	91.1	\$1,350.1	\$1.47	\$1.16
Portfolio (All Sectors)	1,375.0	\$4,971.1	\$0.40	\$0.34



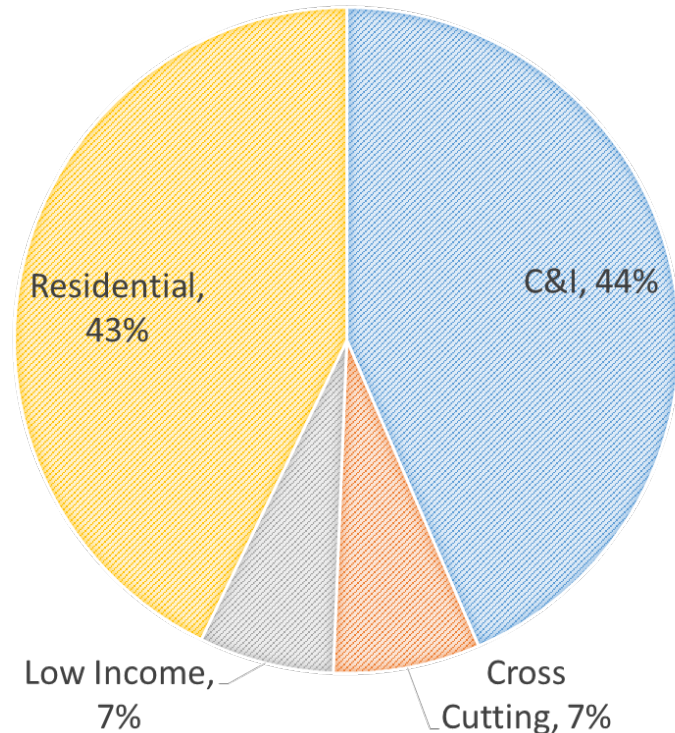
# Spending and Savings by Sector

- ◆ Residential and low-income sectors account for 48% and 28% of spending in our sample, respectively
- ◆ Annual *savings* for residential and C&I are roughly equivalent

GAS PROGRAM SPENDING BY SECTOR



GAS PROGRAM ANNUAL SAVINGS BY SECTOR



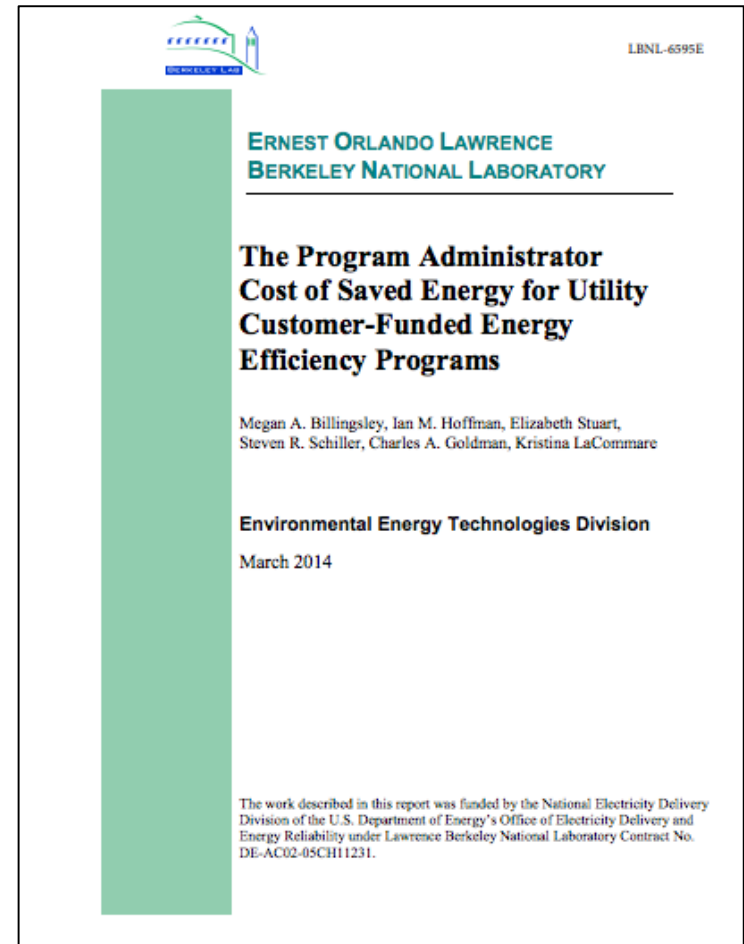
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# Results

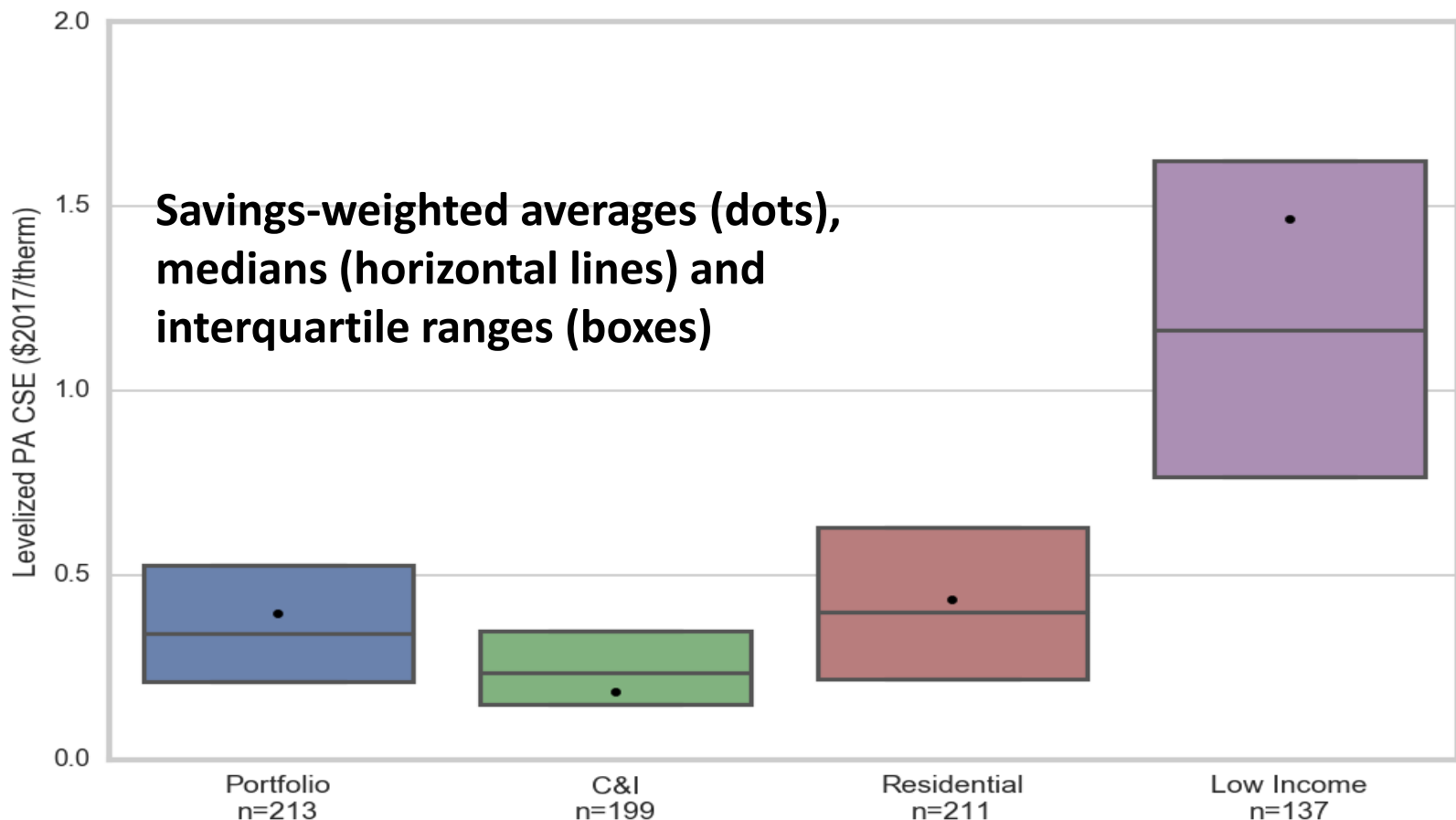
# National Results

- ◆ Savings-weighted average PA cost of saving gas is \$0.40/therm for our 12-state sample over the 2012-2017 study period
- ◆ Results are similar to a [2014 Berkeley Lab study](#), which estimated savings at \$0.38/therm from 2009 to 2011



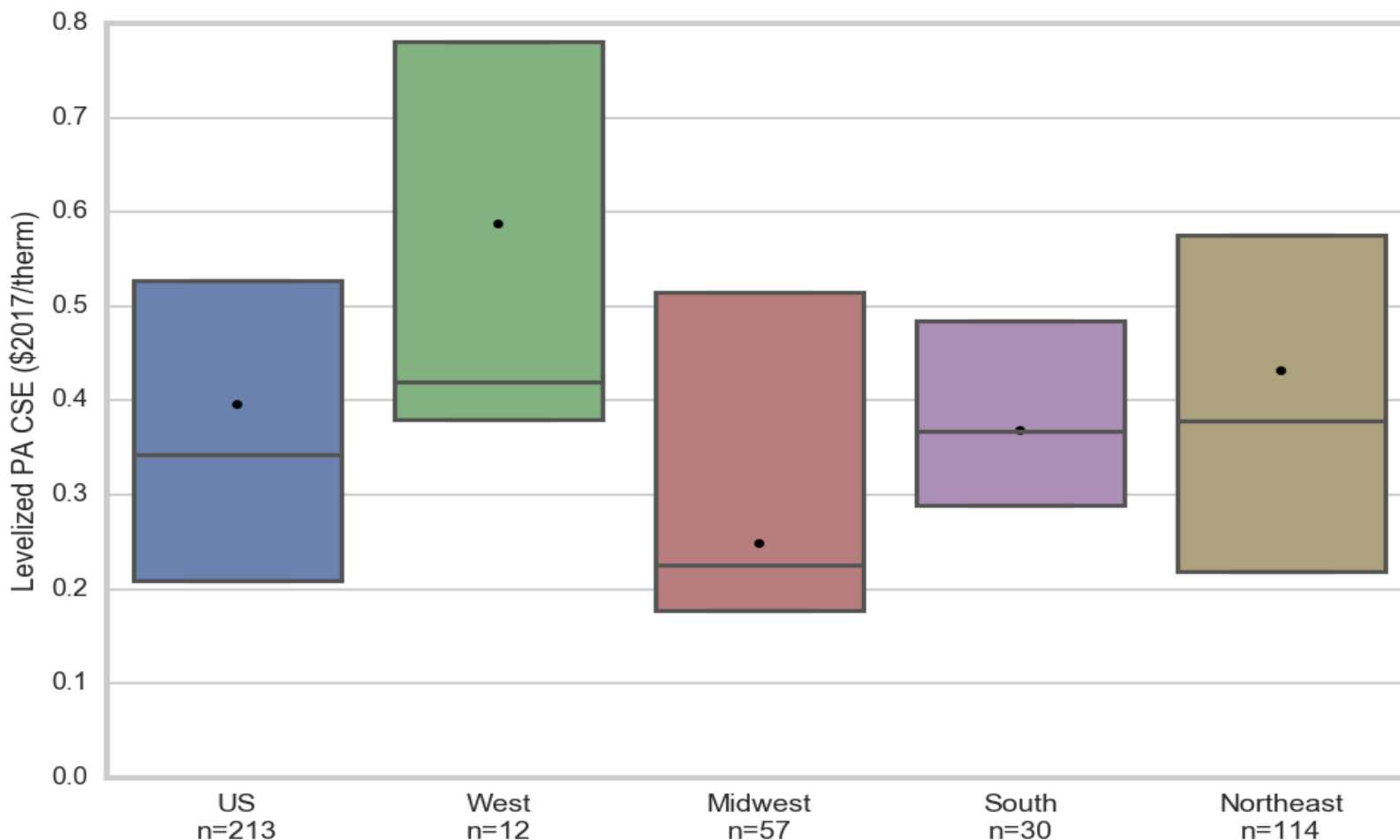
# Cost by Market Sector

- ◆ C&I programs provided savings at the lowest savings-weighted average cost (\$0.18/therm). The cost of residential and low-income programs was \$0.43/therm and \$1.47 per therm, respectively.
  - ▣ Residential and low-income programs represent  $\sim\frac{3}{4}$  of spending in our dataset.

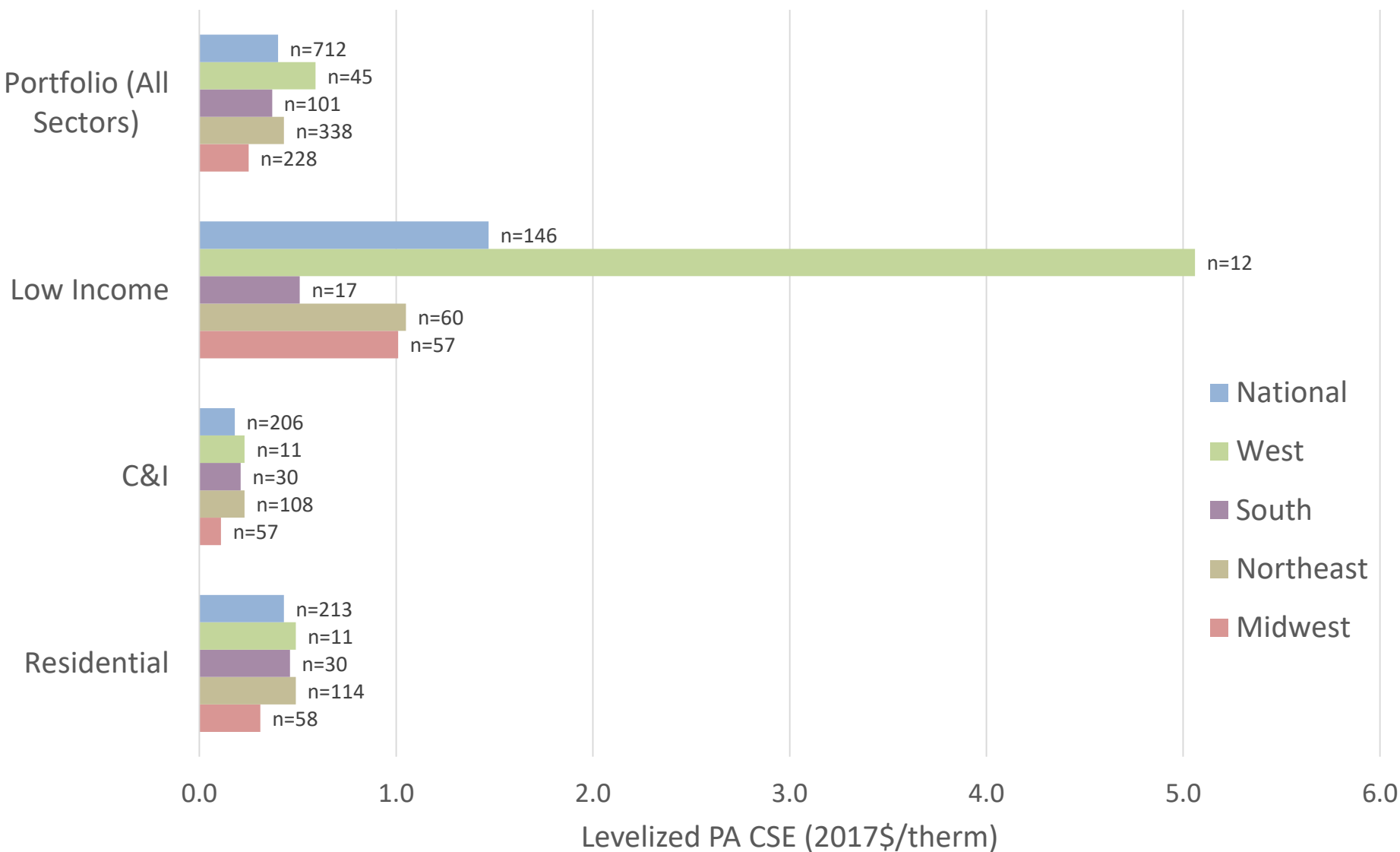


# Costs by Region

- ◆ Cost/therm varies by region—e.g., Midwest at \$0.25 vs. West at \$0.59
- ◆ High spending on low-income programs in West likely drives some of this disparity; also, weather-driven differences in savings opportunities

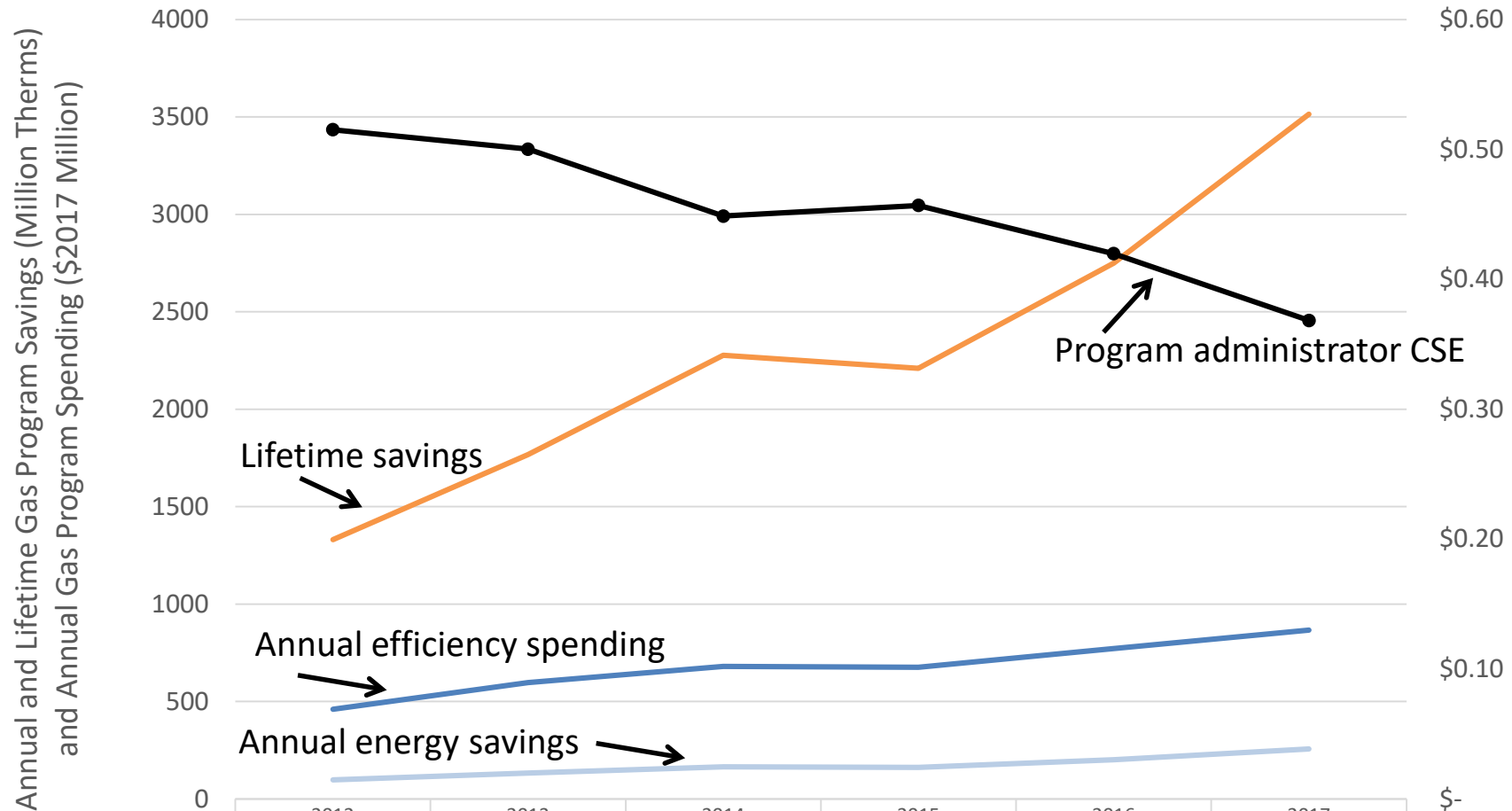


# Results by Sector and Region



# Cost and Savings Trends

- ◆ Average CSE values trended downward from 2012 to 2017
- ◆ Annual achieved savings trended up, at higher rate than spending



	2012	2013	2014	2015	2016	2017
Annual Savings (Million Therms)	98.6	132.7	164.4	161.4	200.7	257.4
Spending (\$2017 Million)	\$460.89	\$597.08	\$680.81	\$675.58	\$772.26	\$867.11
Lifetime Savings (Million Therms)	1330.8	1767.5	2276.5	2209.8	2750.0	3514.6
Levelized PA CSE (\$2017/therm)	\$0.52	\$0.50	\$0.45	\$0.46	\$0.42	\$0.37



# Challenges and Opportunities

# Data and Reporting Challenges

- ◆ Data quality and screening challenges — for example, program administrator definition, estimation and reporting of:
  - ❑ Savings metrics
  - ❑ Program costs
  - ❑ Market sectors
  - ❑ Program types
  - ❑ Measure lives
- ◆ Reporting of gas program data has improved in many states. But significant and meaningful opportunities remain for greater transparency, rigor and comprehensiveness in data reporting.

# Opportunities: Additional Research

- ◆ This work could be strengthened and supplemented with the following additional research:
  - ❑ Expand data collection to other states for fuller geographic representation, larger sample size and greater confidence in the results
  - ❑ Provide technical guidance and support to states and PAs for more consistent reporting and improvements in evaluation, measurement, and verification and estimation of savings from natural gas efficiency programs
  - ❑ Conduct analyses to identify the drivers of a downward trend in the average PA CSE from 2012 to 2017, as well as factors such as climate that drive differences in the cost of saving gas across states
  - ❑ Analyze PA CSE for gas by efficiency program type (e.g., residential new construction, industrial process, commercial heating, ventilating and air-conditioning)
  - ❑ Develop a cost curve for gas efficiency programs
  - ❑ Assess the potential impact of PA size on cost
  - ❑ Estimate the Total CSE for natural gas programs, including participant costs

# Q&A

Please use the **Q&A box**  
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comments.

# For More Information



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