Energy Technologies Area Lawrence Berkeley National Laboratory

Cost of Saving Electricity Through Efficiency Programs Funded by Customers of Publicly Owned Utilities

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Webinar presentation – January 15, 2020

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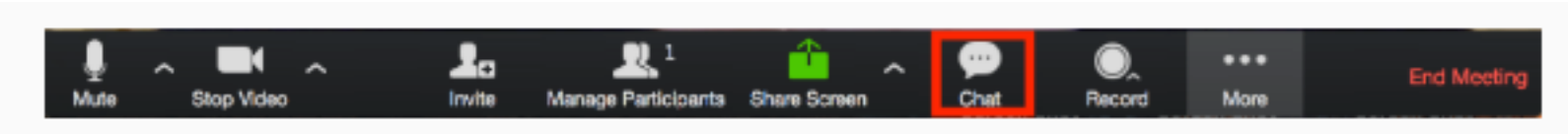
Agenda

- Why energy efficiency and its cost performance matter
- Scale of efficiency investments funded by utility customers
- APPA and energy efficiency activities for publicly owned utilities
- Berkeley Lab's new study for publicly owned utilities
  - Overview of our cost of saving electricity studies
  - Data collection and analysis approach
  - Reported spending and savings by market sector
  - Results: Program administrator cost of saving electricity—national, regional, market sector—and cost trends over time
- Challenges and potential research areas
- Reporting tool for publicly owned utilities
- Moderated Q&A

Webinar Housekeeping Items

- The report and webinar slides are posted at https://emp.lbl.gov/publications/cost-saving-electricity-through-0.
- 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 chat 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.

Why Energy Efficiency and Its Cost Performance Matter

- Energy efficiency helps ensure electricity system reliability at the most affordable cost as part of resource adequacy planning and implementation activities.
  - Efficiency is an energy and capacity resource.*
  - Spending on utility customer-funded programs is growing.
  - Increasing levels of variable renewable energy, and declining costs of wind, solar and natural gas, call for a better understanding of the impacts of energy efficiency investments.
- Improved data on efficiency's cost performance can be used:
  - To project efficiency's impact on electricity load forecasts
  - To benchmark program results with regional and national estimates
  - For initial screening of electricity resource alternatives, as one consideration for targeting markets, end-uses and measures
  - To evaluate how program costs are likely to change over time with funding levels and participation

*See our new report, *Peak Demand Impacts From Electricity Efficiency Programs*

Scale of Efficiency Investments

- Spending on electricity efficiency programs funded by customers across all types of utilities was about ~$5.8B in 2016 and ~$6.1B in 2017.*
- Berkeley Lab projects spending to increase to $8.6B by 2030 in our medium scenario.**
  - 3-4% annual growth to 2025, slowing to <1% in 2025-2030 period

*Consortium for Energy Efficiency

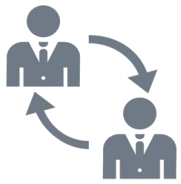
**_The Future of U.S. Electricity Efficiency Programs Funded by Utility Customers: Program Spending and Savings Projections to 2030_

APPA and Energy Efficiency Activities for Publicly Owned Utilities

AMERICAN PUBLIC POWER ASSOCIATION

Trade association representing
public power utilities across the U.S.

MEMBER EDUCATION
AND INFORMATION



POLICY
ADVOCACY

BEST PRACTICES
AND RESOURCES

What Is Public Power?

Community-owned, not-for-profit public power utilities power homes and businesses in 2,000 communities — from small towns to large cities.

#PublicPower

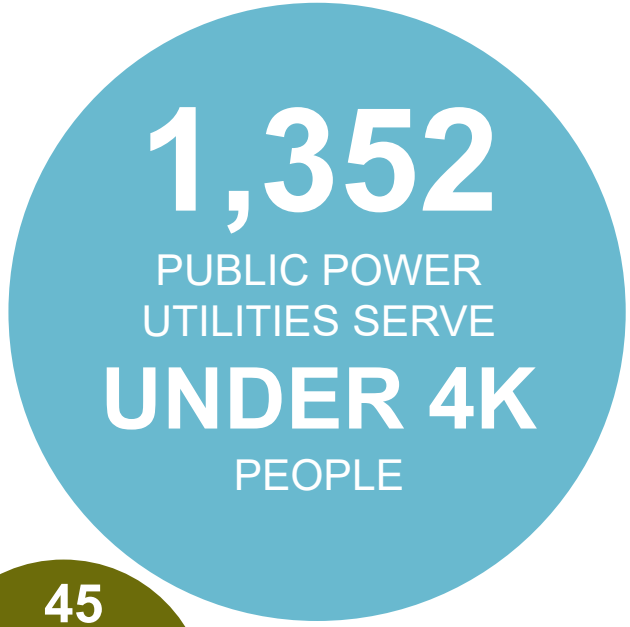
PUBLIC POWER UTILITIES ARE LIKE OUR PUBLIC SCHOOLS AND LIBRARIES

Community-owned

Division of local government

Elected or appointed boards—mayors, council members, citizens

HOW MANY PEOPLE DOES A PUBLIC POWER UTILITY SERVE?



PUBLIC POWER

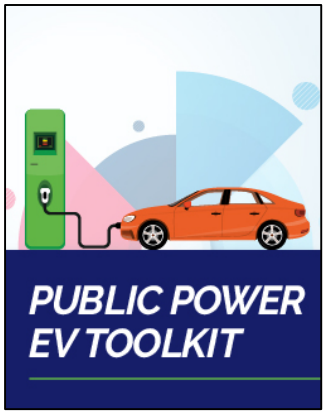
LOCAL CONTROL

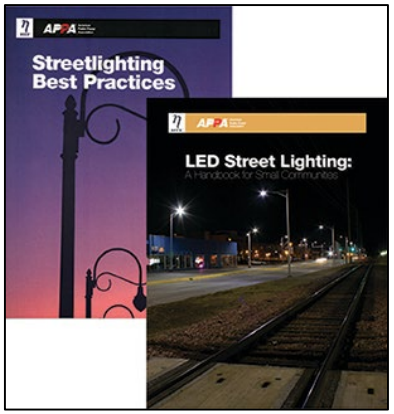
LOW RATES

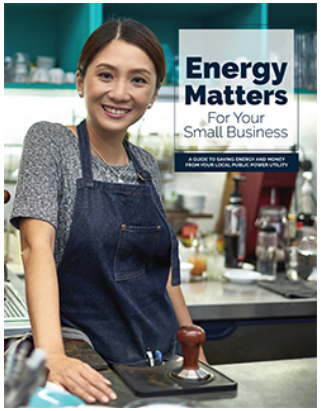
HIGH RELIABILITY

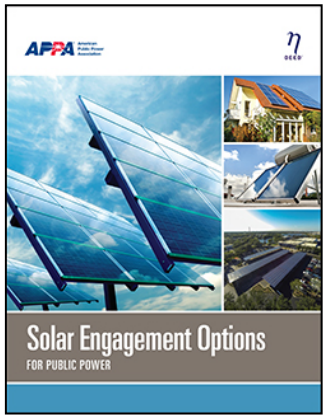
Funding Energy Efficiency R&D

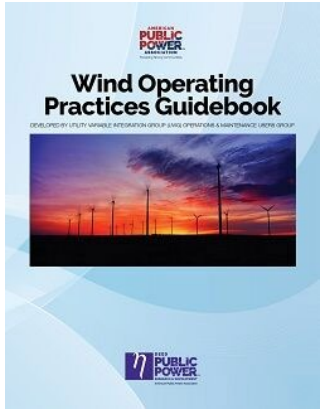
- Demonstration of Energy & Efficiency Developments (DEED):
  - National R&D program for public power utilities
  - Funding for innovative projects & student interns
  - Sharing knowledge and transferring technology via reports & resources











https://www.publicpower.org/deed-rd-funding

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40 Years of Innovation

Smart Energy Provider Program

- A best practices designation for utilities that show proficiency in energy efficiency, distributed generation, renewable energy, and environmental initiatives.
- Helps public power utilities benchmark their work in this area against others in the industry
- Provides a vehicle for peer evaluation based on a set of industry best practices

https://www.publicpower.org/smart-energy-provider

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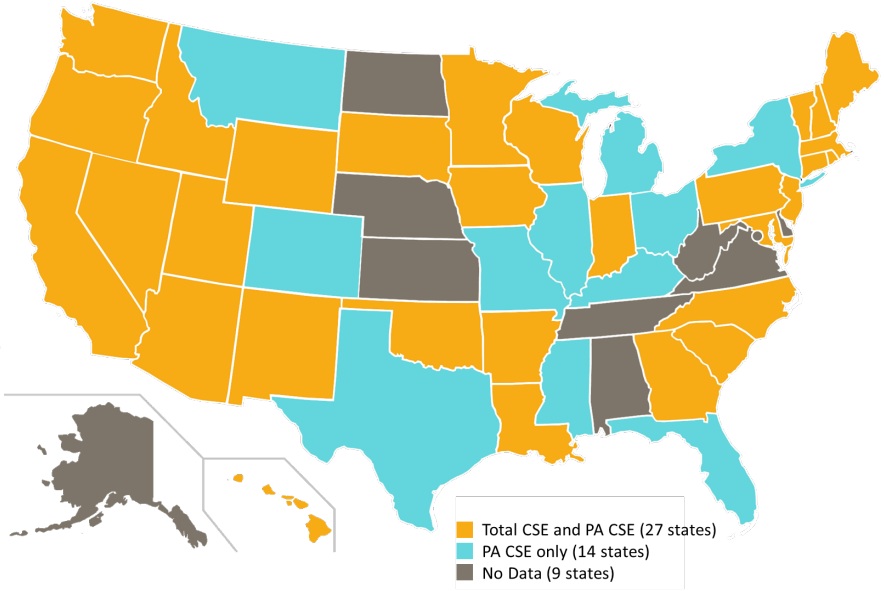
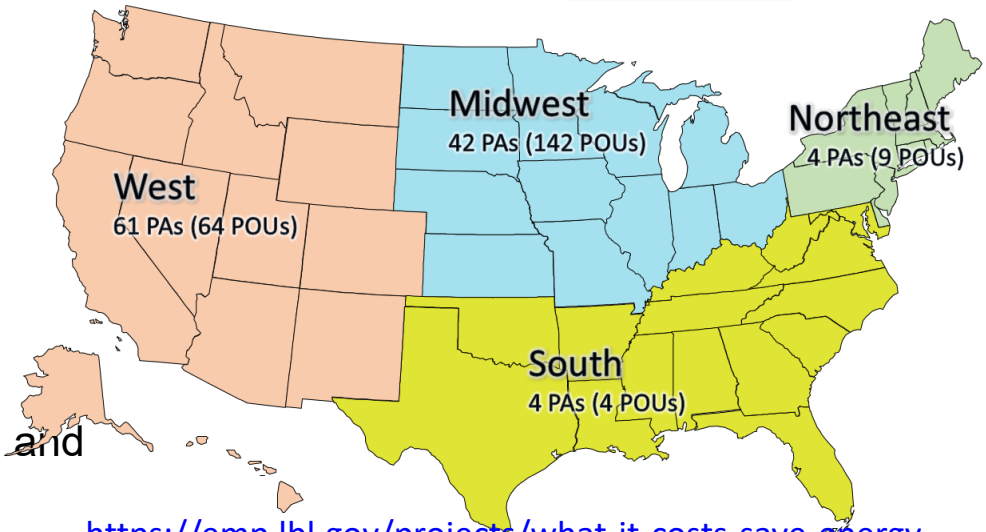
SMART ENERGY PROVIDER
American Public Power Association

Berkeley Lab's New Study on the Cost of Saving Electricity for Publicly Owned Utilities

Berkeley Lab Studies on Cost of Saving Electricity

- Investor-owned utilities (IOUs)
  - Analysis at program level and by market sector
  - Program administrator (PA) CSE
  - Total CSE, including participant costs
  - 116 PAs in 41 states, 2009-15
  - Cost of saving peak demand, 9 states, 2014-17
- Publicly owned utilities (POUs)
  - Our first CSE study for POUs
  - Analysis at market-sector level
  - Program administrator CSE only
  - 111 PAs, representing 219 POUs in 14 states, 2012-17
- >13,000 program years* of data
  - Annual savings, budgets & expenditures
  - Program type & avr. measure lifetimes
  - Other data: lifetime savings, net savings, and number of participants, projects or units.



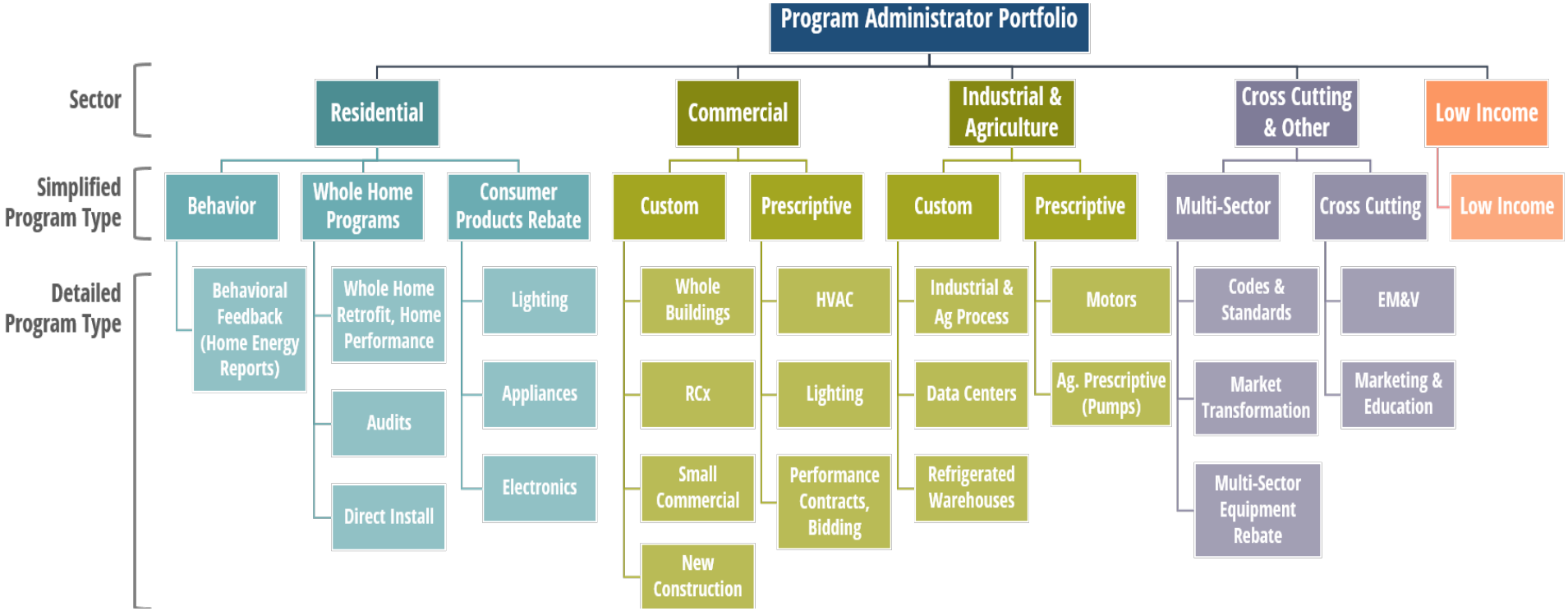


https://emp.lbl.gov/projects/what-it-costs-save-energy

*Spending and savings data for a *single program* for a single year — e.g., 4 program years represent data for 4 years of spending and savings for a particular program.

LBNL Efficiency Program Typology

- Characterizes programs by market sector, technologies and delivery approaches
  - Reflects range of reporting detail and enables multiple levels of analysis
- 27 simplified program types and 65 detailed program types



See LBNL brief, *Energy Efficiency Program Typology and Data Metrics: Enabling Multi-State Analyses Through the Use of Common Terminology*

**Figure is illustrative. Not all program types are depicted.*

Berkeley Lab's Initial Study on Cost of Saving Electricity for Publicly Owned Utilities

- Partnership with APPA
- POUs account for 60% of all U.S. electric utilities.*
- In 2017 POUs served ~15% of U.S. electricity customers and 16% of utility electric load (U.S. EIA).
- POUs are primarily municipal utilities; some are public utility districts or other public entities.
- Municipal associations, public power districts, bulk power suppliers for municipal utilities, joint action agencies, and municipal aggregators often administer programs and report program spending and savings on behalf of multiple POUs.
- Unlike IOUs, state public utility commissions generally do not oversee POU electricity efficiency programs.

*APPA. 2019. Stats and Facts. https://www.publicpower.org/public-power/stats-and-facts.

Data Collection and Analysis Approach, Reported Spending and Savings

Data Collection (1)

- APPA's request for POUs to provide data for our study
- Direct solicitations by Berkeley Lab
- Data collection by Large Public Power Council members
- Annual reports posted on a website by utility or other PA
- Annual reporting to state entity
- Regional data collection for multiple PAs — e.g., Pacific NW

Data Collection (2)

- Factors for **prioritizing collection** of program data:
  - Geographic diversity
  - Likelihood of acquiring complete data (savings and full program spending) and reporting of program- or sector-level measure lifetimes
  - Data for large POUs with diverse markets, mostly retail sales and generally robust reporting, in order to use these utilities' large volumes of savings and related costs in our analyses
  - Bolstering the database with smaller POU program administrators, as indicated by retail electricity sales and efficiency program spending, to better reflect program diversity
  - Obtaining data sources with reporting by large numbers of individual program administrators
  - We did not collect efficiency program data for POUs selling primarily to governmental entities, utilities or other wholesale customers.

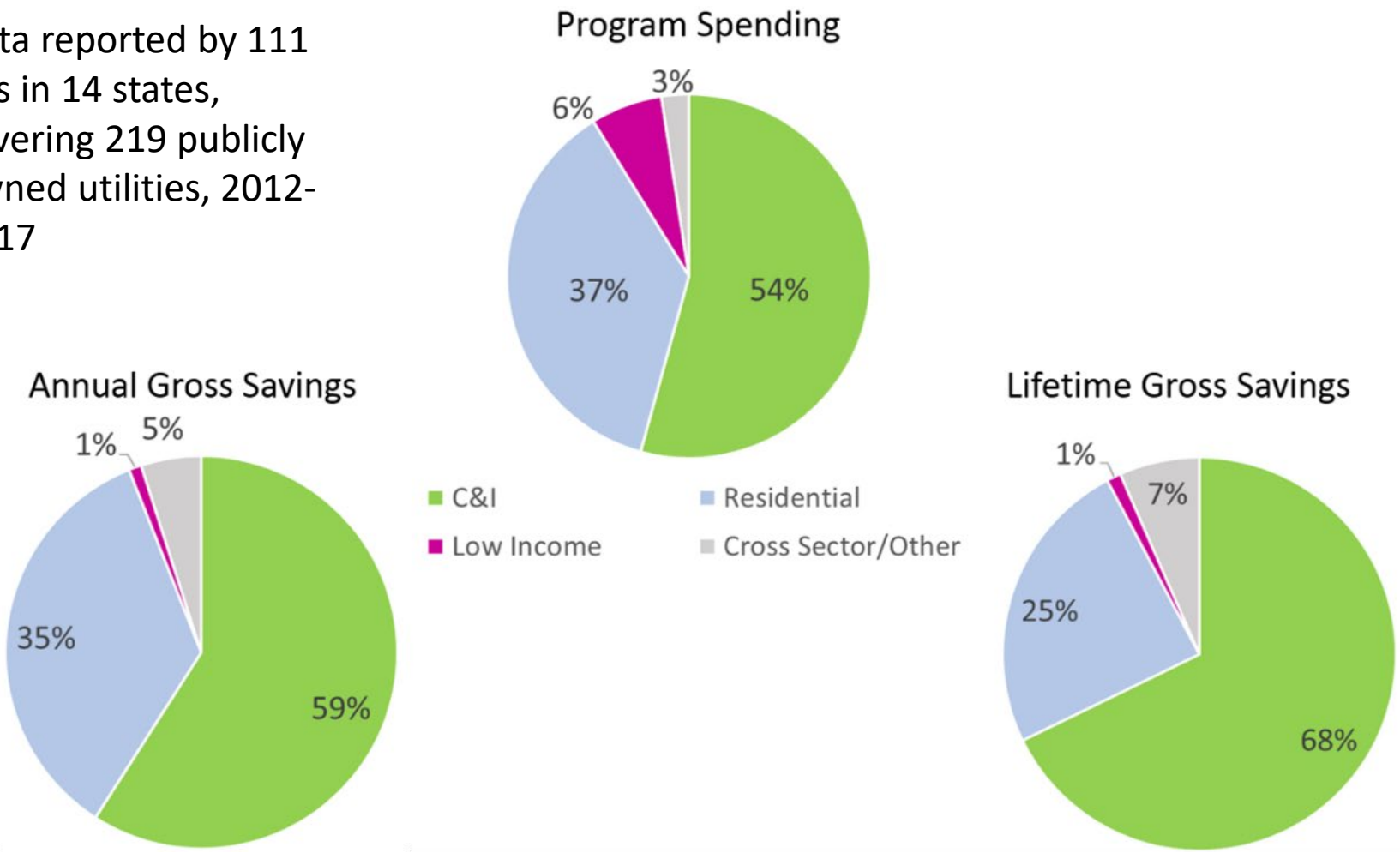
- **Decision rules** for data collection and analysis — e.g., excluding PAs serving a large and inseparable share of non-POU customers (e.g., wholesale accounts or customers of rural cooperatives), as well as data without full program costs

Reported Spending and Savings Coverage

- Data reported by 111 PAs in 14 states, covering 219 publicly owned utilities, 2012-2017
  - These POUs account for 90% of municipal utilities and public utility districts that report efficiency program data to the EIA
- Our dataset includes ~$2.4 billion (2017$) in reported spending on electricity efficiency programs funded by POU customers during the 2012-2017 period.
  - Represents 88% of POU efficiency spending reported to EIA
  - Spending represents about 1.9% of 2012-2017 revenues of POUs matched with EIA data
- The 111 program administrators in our dataset reported 11,329 gigawatt-hours (GWh) of annual savings for the study period.
  - Represents ~75% of POU efficiency savings reported to EIA
  - Savings represent about 1.2% of retail sales for POUs matched with EIA data

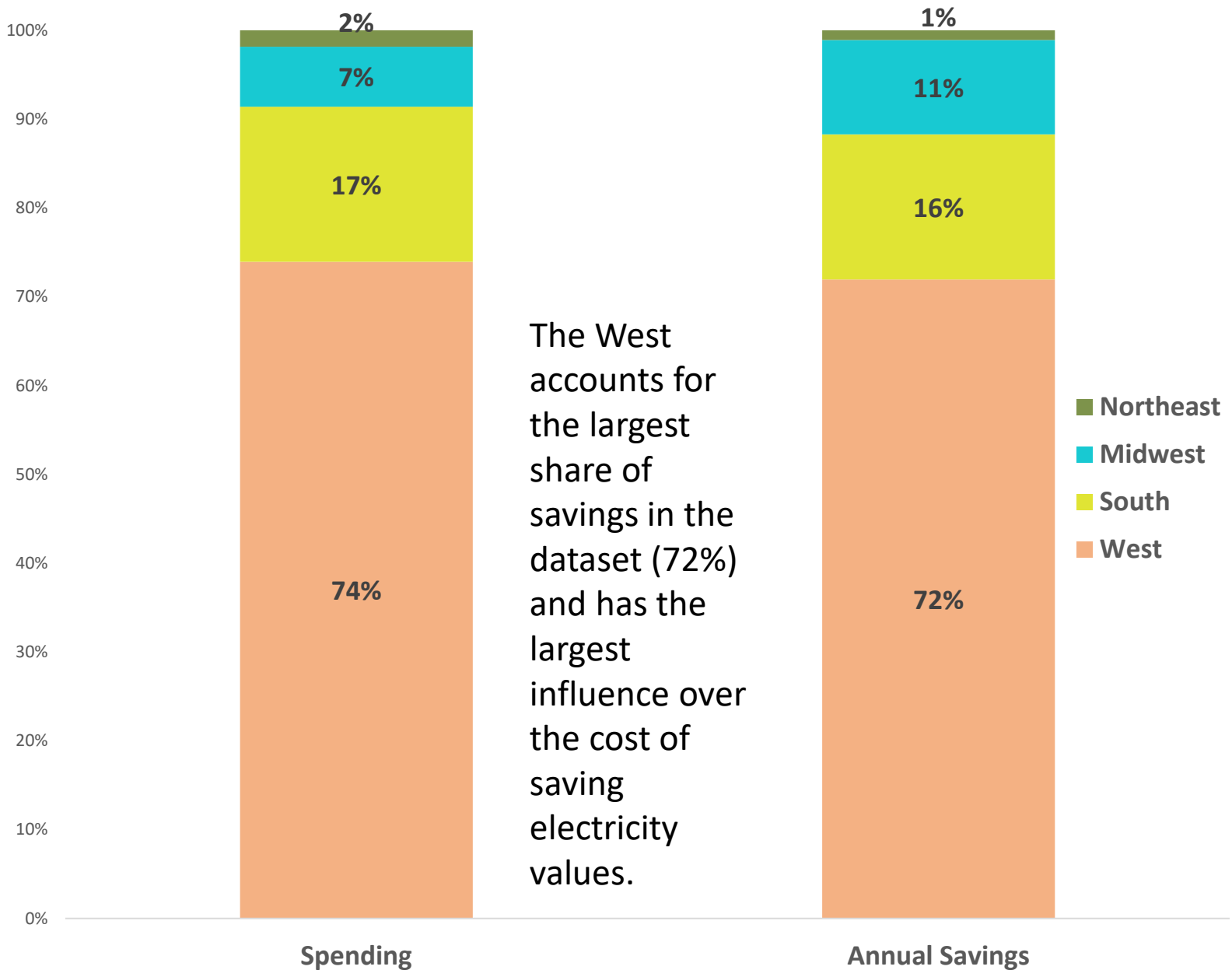
Reported Spending and Savings by Market Sector

Data reported by 111 PAs in 14 states, covering 219 publicly owned utilities, 2012-2017



- The C&I sector accounts for 54% of the spending total. Programs targeting residential and low-income customers account for 37% and 6%, respectively.
- The C&I sector also accounts for the highest share of annual and lifetime gross savings.

Regional Distribution of Program Spending and Savings



The West accounts for the largest share of savings in the dataset (72%) and has the largest influence over the cost of saving electricity values.

Definition: PA Cost of Saving Electricity

Levelized Program Administrator Cost of Saving Electricity (PA CSE)	The cost to the *program administrator* for achieving electricity savings over the economic lifetime of the actions taken, discounted back to when the costs were paid and the actions occurred

Assumptions and inputs:

- 4% discount rate (real)
- Estimated program average measure lifetimes
- Total program cost (not including participant contributions), including incentives (2017$)
- Gross annual kWh saved

Program Administrator Cost of Saving Electricity =

$$\frac{Capital\ Recovery\ Factor\ *\ (Program\ Administrator\ Costs)}{Annual\ Electricity\ Savings\ (in\ kWh)}$$

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

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

Savings-Weighted Measure Lifetimes by Market Sector

Market Sector	Savings-Weighted Measure Lifetime (years) Assumed in PA CSE Analyses
C&I	12.7
Residential	7.7
Low Income	12.5
Cross Cutting/Cross Sector	14.7
Portfolio	11.8

- To calculate the cost of saving electricity, we spread the cost of a program over its average measure lifetime.
- We used measure lifetimes reported by the program administrator for each program. Where unavailable, we imputed the value using the average of reported and calculated values for each program type. We also imputed market-sector values when not reported, by dividing reported or calculated lifetime savings for all programs in that market sector by their annual savings.
- The result is savings-weighted average measure life by market sector.

Send us your questions and comments in the chat box

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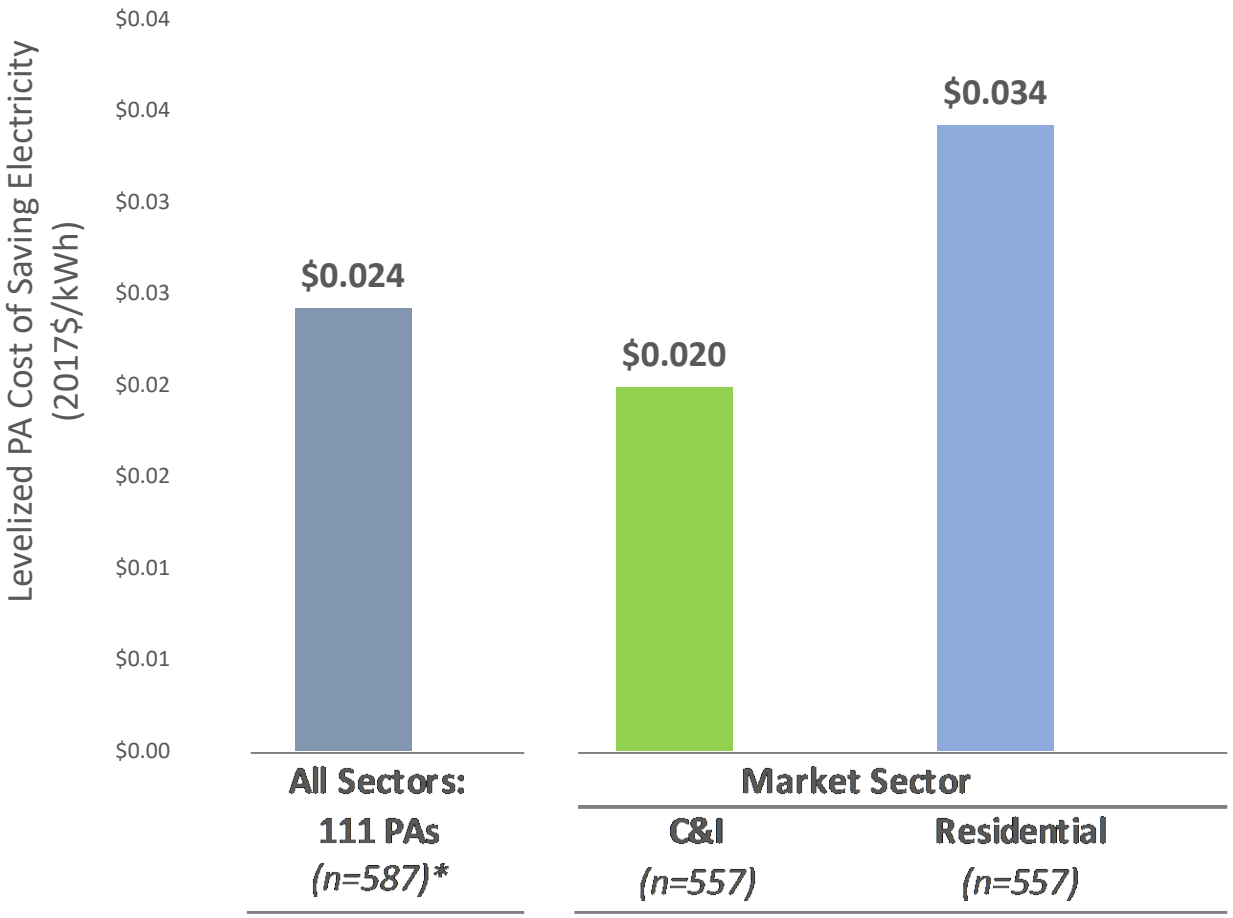
Results

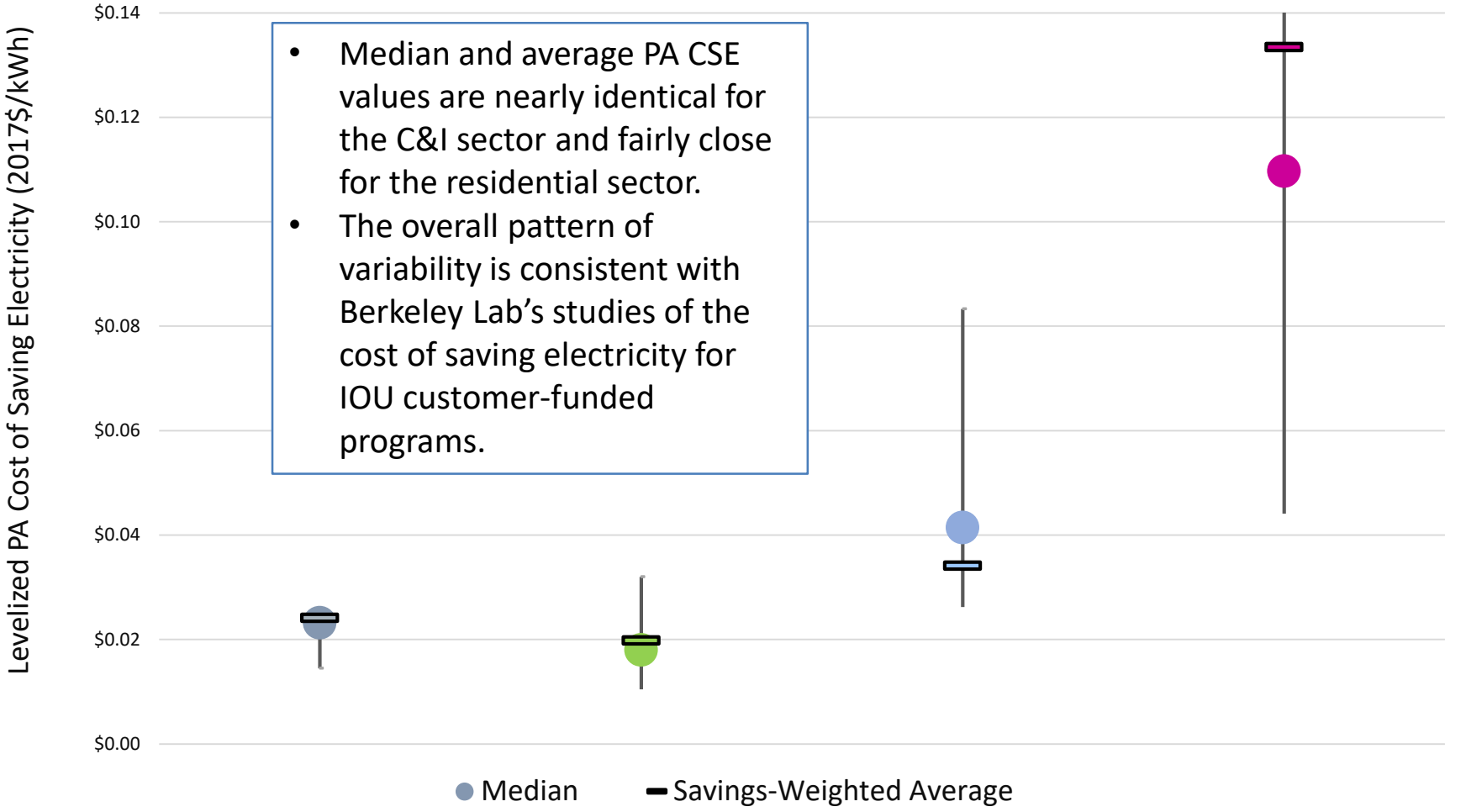
Program Administrator Cost of Saving Electricity: National Results (2012-2017)

- All sectors, 111 PAs: $0.024/kWh
  - C&I programs: $0.020/kWh
  - Residential programs: $0.034/kWh
  - Low-income programs: $0.133/kWh (separate category)



** Includes cross-sector activities for which savings are sometimes not claimed, but which support efficiency activities (e.g., planning, research, market assessments, evaluation and measurement).*

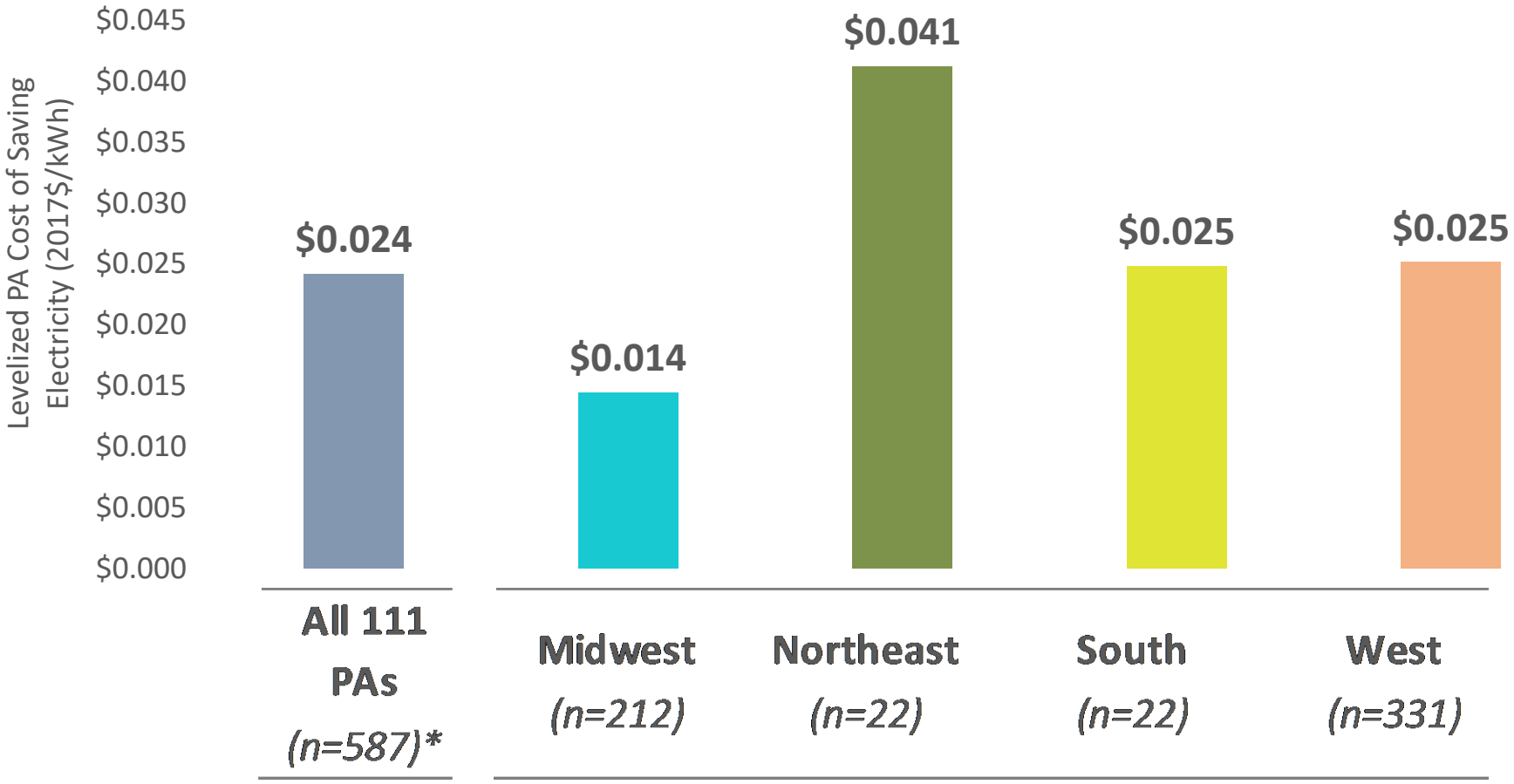
Program Administrator Cost of Saving Electricity: Sector Medians and Averages



- Median and average PA CSE values are nearly identical for the C&I sector and fairly close for the residential sector.
- The overall pattern of variability is consistent with Berkeley Lab's studies of the cost of saving electricity for IOU customer-funded programs.

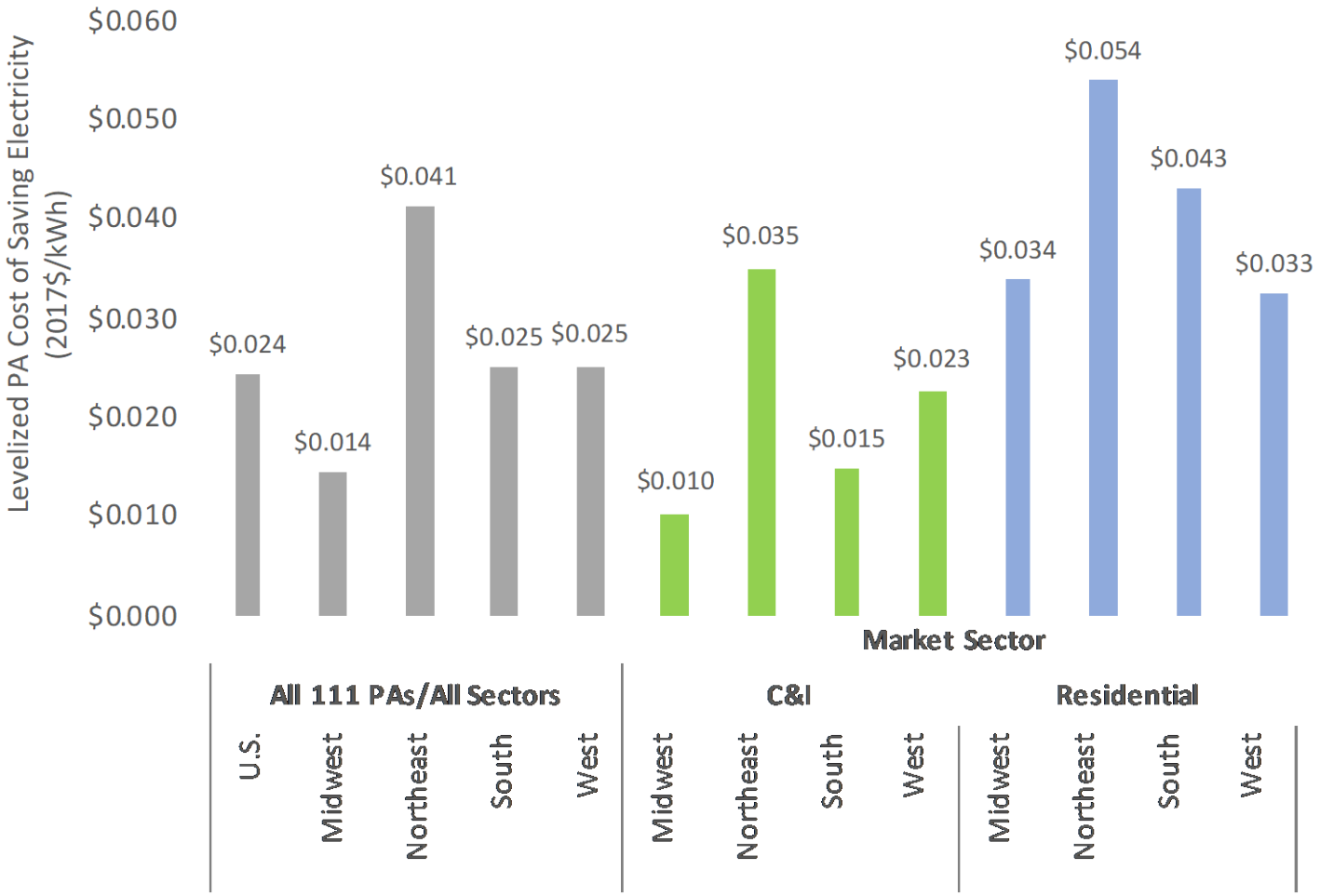
All Sectors: 111 PAs	Market Sector		
	C&I	Residential	Low Income

Program Administrator Cost of Saving Electricity: Results by Census Region



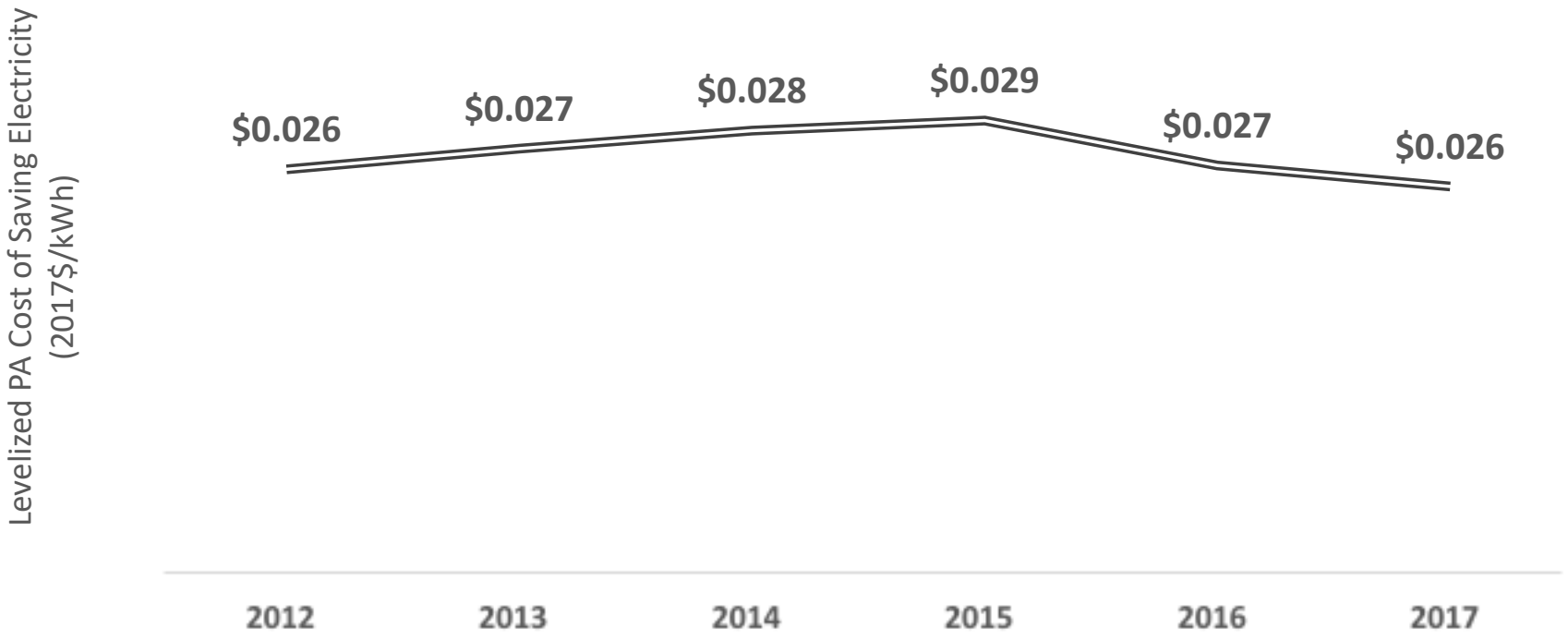
- The savings-weighted PA CSE ranges from $0.014/kWh in the Midwest to $0.041/kWh in the Northeast, a nearly three-fold difference.
- With 88% of savings in the dataset, the West and South largely define the national average.

Program Administrator Cost of Saving Electricity: Regional Results by Market Sector



- Programs that target the low-income and residential market sectors have the most variability, likely reflecting diversity in program designs and performance.

Program Administrator Cost of Saving Electricity: Trend for 79 POU program administrators – 2012-2017



- Our cost trends analysis used data from 79 program administrators with continuous data over the study period.
- We found costs were fairly constant from year to year, while total electricity savings increased slightly—from 1.1% of the utilities' retail sales in 2012 to 1.3% in 2017.

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Challenges and Potential Research Areas

Challenges

- POU program administrators face many of the same challenges as program administrators for investor-owned utilities—for example:
  - Completeness of reporting on impacts and costs of efficiency investments at the program level
  - Rigor of program average measure lifetimes
  - Transparent and consistent assumptions and methods
    - State or regional technical reference manuals can help.
  - Uniform application of net and gross savings definitions
  - Standardized reporting of electricity savings with respect to transmission and distribution losses (i.e., source versus site savings)
  - Consistent program definitions (e.g., Berkeley Lab's typology)

Potential Future Research Areas

- Collecting and analyzing data from additional POUs for larger sample size and more diversity
- Program-level analysis of cost performance for the most prevalent POU program types
- Trends in cost performance by market sector and for select programs where POU program administrators get the most electricity savings
- Total cost of saving electricity for POU programs, including participant costs
- Cost performance for large versus small POU program administrators, for a range of program types
- Model energy efficiency programs for smaller POUs
- Assisting POUs in ways to separately report low-income programs from other residential programs to improve understanding of costs attributable to programs targeting low-income households

Energy Efficiency Reporting Tool (1)

- Reporting practices for energy efficiency vary widely across all types of utilities.
- More consistent and comprehensive data offer potential benefits to utilities.
  - Benchmarking program cost performance to state, regional and national values for similar markets
  - Identifying opportunities for performance improvements and cost efficiencies
  - Reduced time for staff to assess reporting compliance
- In cooperation with APPA, Berkeley Lab developed a simplified energy efficiency program reporting tool for small to medium-sized publicly owned utilities.
  - The Excel-based template is designed to produce consistent, useful metrics on program investments and performance.
  - The tool uses a standard program typology and cost categories.

Energy Efficiency Reporting Tool (2)

- Program category (sector, type)
- Program implementer
- Program description
- Claimed annual savings
- Claimed lifetime savings
- Measure life
- Number of participants/ units
- Program expenditures by category
- Fuel

Average Measure life (yrs)*		Claimed Lifetime Savings*				Claimed Annual Savings			
Electricity	Gas	Lifetime Electricity Savings (MWh)		Lifetime Gas Savings (therms)		Annual Electricity Savings (MWh)		Annual Gas Savings (therms)	
Average Reported Electricity Measure Lifetime	Average Reported Gas Measure Lifetime	Claimed Lifetime Gross Electricity Savings	Claimed Lifetime Net Electricity Savings	Claimed Lifetime Gross Gas Savings	Claimed Lifetime Net Gas Savings	Claimed Annual Gross Electricity Savings	Claimed Annual Net Electricity Savings	Claimed Annual Gross Gas Savings	Claimed Annual Net Gas Savings
10		200,000	170,000			20,000	17,000		

Main Menu

Glossary

Term	Definition
# Participants	Total number of consumers participating in the subject program. For new construction programs, we classify "number of homes or buildings" as the number of participants. In some programs, the number of participants will be the number of structures or multifamily units that received efficiency measures through a program.
# Units	Total number of measures installed or credited with savings in the subject program (e.g., number of CFLs for which savings are claimed in a lighting program). If the number of units reported for a new construction or retrofit program is defined as structures built or retrofitted to a higher level of energy performance, then these are not counted as units but as participants.
Administration Costs ($)	Actual spending by the program administrator (PA) on costs associated with planning, designing and implementing an energy efficiency program in a defined geographic area, unless some of those costs are specifically accounted for elsewhere. In general, these costs pay for the salaries, training and equipping of internal PA staff to administer and implement a program or oversee the work of an outside contract implementer. If evaluation, compliance and marketing, outreach & education costs are not reported separately, then they typically are included under program administration costs. When a program is being terminated, shut-down costs also should be included in administration costs.

Navigation Buttons

Built-in Glossary

Q&A

- Report authors will now respond to your questions.
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For More Information

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