CEE Annual Industry Report

2017 State of the Efficiency Program Industry

BUDGETS, EXPENDITURES, AND IMPACTS

Consortium for Energy Efficiency

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PURPOSE AND LIMITATIONS

The purpose of this report is to provide both a point in time report and an annual time series analysis of US and Canadian program industry energy efficiency and demand response budgets, expenditures, and savings. While this effort constitutes a large and comprehensive survey of program administrators, and while extensive ongoing attention is devoted to data standardization, CEE cautions against making representations and comparisons beyond those provided in this report.

The report documents annual electric and natural gas DSM program industry budgets, expenditures, and impacts at the national level and, where appropriate, by Census region, across the United States and Canada based on data collected through a vast and comprehensive survey of DSM program administrators. CEE believes that using these data in conjunction with past survey efforts accurately portrays energy efficiency program industry trends over time. The limitations of the data are disclosed below.

There are many limitations to budget, expenditures, and savings data in the DSM industry. First, this survey represents self-reported data by an individual or group of individuals within each responding organization. Although CEE and collaborator American Gas Association work closely with each responding organization to help respondents properly interpret survey questions and enter the correct information, the accuracy of the data is not verified outside of these efforts. Second, respondents provide data at different times during the data collection period from June to October, and not all program administrators report their information according to the calendar year. CEE and AGA have sought greater consistency in data collection from respondents over the years, however, the accuracy of the data is ultimately dependent upon each individual respondent's interpretation of the survey questions, ability to retrieve the relevant information, and verification of the data provided. Furthermore, variation in state policies and reporting requirements along with what we suspect is inconsistent use of terminology likely adds to variation.

Additional factors that affect the viability of comparisons or analytical inferences include differences in regulatory structures, weather effects, customer demographic differences, electric and gas rates, the duration of program experience, and underlying drivers that shape a program administrator's portfolio.

Given the wide variation in the circumstances surrounding individual data points, we do not believe these data are suitable for comparisons at any level other than the levels represented within this report. CEE encourages reviewers to inquire as to the sufficiency of the method or quality of supplemental data for the specified purpose when using this information beyond the stated limits.

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ACKNOWLEDGEMENTS

CEE would like to thank the gas and electric energy efficiency and demand response program administrators in the United States and Canada that participated in this year's industry data collection. We appreciate the time and effort given by all survey respondents throughout the data collection process, including extensive clarification and follow-up. CEE is also grateful to members who have provided feedback and insights on this work over the years.

CEE appreciates our continuing collaboration with the American Gas Association (AGA), which provides natural gas industry data collected from their members for a similar research effort. CEE extends special thanks to Mariam Arnaout and Chris McGill of the American Gas Association for their coordination on survey development and the logistics of data collection.

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EXECUTIVE SUMMARY

This report concludes the twelfth consecutive CEE data collection effort and annual report publication. The primary purpose of the survey and accompanying report is to capture industry budgets, expenditures, and impacts over time to enable assessment of overall industry trends. This year's report highlights 2017 budget data[1] and 2016 expenditure and impact[2] data compared to previously reported figures to assess industry growth and observe significant changes.

In 2017, the *State of the Efficiency Program Industry Report* continues to show growth and expansion of the efficiency program industry. Analysis of the data reported by US and Canadian program administrators supports the recent trend of increasing demand side management (DSM[3]) program expenditures. In 2016, combined spending on gas and electric DSM programs across the United States and Canada totaled over $8.8 billion from all sources and $8.5 billion from ratepayers. Industry expenditures are up two percent compared to 2015 expenditures from all sources and represent an 11 percent increase over the last five years. CEE member programs accounted for almost $7.0 billion, or 79 percent, of these expenditures. US and Canadian DSM ratepayer-funded programs are estimated to have saved approximately 30,166 GWh of electricity and 522 million therms of gas in 2016, which represents 25.9 million metric tons of avoided CO_2 emissions.[4]

Other key findings from this year's industry data collection include the following, listed in US dollars (USD):

Binational Trends: DSM Programs in the United States and Canada

- In 2017, US and Canadian combined gas and electric DSM program budgets from ratepayer funds totaled over $9.4 billion out of the

1 The budget data from survey respondents were collected during the summer and fall of 2017. This report does not capture changes made after that time.

2 "Impact data" refers to annually reported energy savings data commonly referred to as "ex ante" savings estimates. Ex ante savings are forecasted savings figures used for program and portfolio planning and reporting purposes. DSM program evaluators often review and revise ex ante savings during program or portfolio impact evaluation studies.

3 For the purposes of this report, DSM programs encompass both energy efficiency (EE) and demand response (DR) funding.

4 Calculated using the EPA Greenhouse Gas Equivalencies Calculator, "Greenhouse Gas Equivalencies Calculator," Environmental Protection Agency, accessed February 2018, epa.gov/energy/greenhouse-gas-equivalencies-calculator.

$9.9 billion budgeted from all sources. This represents a seven percent increase from 2016 ratepayer funded budgets.

- In 2016, US and Canadian program administrators spent nearly $1.1 billion from all sources—99 percent of which came from ratepayers—on demand response programs in 2016, representing an increase of 12 percent as compared to 2015.
- Natural gas program expenditures in the United States and Canada rose one percent between 2015 and 2016, to just over $1.44 billion from $1.42 billion.
- The largest sources of nonratepayer funding budgeted for 2017 US electric DSM activity included wholesale capacity market revenues (2.00 percent) and the Regional Greenhouse Gas Initiative (1.5 percent of total budgets). US electric and gas program administrators also cited several miscellaneous sources,[5] while Canadian electric and gas program administrators reported 100 percent ratepayer funding.

Gas and Electric DSM in the United States

- US gas and electric DSM expenditures totaled $8.2 billion from all sources and over $7.8 billion from ratepayers in 2016, representing an increase of inflation-adjusted expenditures of one percent for expenditures from all sources and a decrease of less than one percent for ratepayer funding as compared to 2015. This represents an eight percent increase in US DSM expenditures over the last five years when adjusted for inflation.
- US DSM expenditures in 2016 represented nearly 0.04 percent of US GDP and 2.79 percent of value added[6] by the US utility industry.
- Ratepayer-funded programs resulted in 25,788 GWh of gross incremental electric savings and 409 million therms of gas savings in 2016.

5 Miscellaneous sources of funding included state funding and shareholder funding.

6 The US Department of Commerce Bureau of Economic Analysis defines value added, or the GDP-by-industry as "the contribution of a private industry or government sector to overall GDP… Value added equals the difference between an industry's gross output … and the cost of its intermediate inputs." "Frequently Asked Questions: What is industry value added?" US Department of Commerce Bureau of Economic Analysis, accessed March 2018, bea.gov/faq/index.cfm?faq_id=184.

Gas and Electric DSM in Canada

- Canadian gas and electric DSM program expenditures increased to $675 million USD in 2016, an increase of one percent compared to 2015 expenditures. However, this increase overcomes a CAD-to-USD exchange rate that continued to fall from 2015 to 2016, as Canadian DSM expenditures in 2016 totaled over $894 million CAD, an increase of four percent over 2015. While Canadian DSM expenditures remained consistent from 2010 to 2014, mostly staying around $800 million USD, the 2015 and 2016 totals have each represented the highest annual expenditures seen over the history of this report at the time of their reporting.
- Canadian DSM expenditures in 2016 represented 0.05 percent of Canadian GDP and 2.00 percent of value added by the Canadian utility industry.
- In 2016, ratepayer-funded DSM programs resulted in 3,023 GWh of gross incremental electric savings and 112 million therms of gas savings.

This is the ninth consecutive year of collaboration with the American Gas Association (AGA). Working with AGA has streamlined data collection efforts and has helped increase participation and response rates for this survey. The 2017 report reflects data for 306 utility and nonutility program administrators[7,8] operating efficiency programs in all 50 US states, the District of Columbia, and eight Canadian provinces. More information regarding the 2017 data collection process can be found in Section 2.

7 Survey respondents include electric and gas CEE members, program administrators who are members of AGA, large program administrators who are not members of either organization, and some other program administrators identified through EIA Form 861 DSM data: "Electric power sales, revenue, and energy efficiency Form EIA-861 detailed data files," US Energy Information Administration, http://www.eia.gov/electricity/data/eia861/.

8 Please note that an error was identified in the 2016 responding utilities total. CEE reported last year that this total was 321, but this value should have been listed as 308. The corrected total reinforces the comparability of the respondent totals between 2016 (308) and 2017 (306), and the corresponding analysis throughout this report.

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FIGURES

1 Introduction

Over the past twelve years, CEE has collected data from demand side management (DSM) program administrators in the United States and Canada to provide insight to industry stakeholders regarding overall trends for the electric and natural gas efficiency program industry. In that time, the data have shown vibrant and stable growth in industry expenditures and have illustrated that each year energy efficiency and demand response programs provide a tangible source of energy savings. In the last five years alone, from 2012 to 2016, US and Canadian combined gas and electric DSM inflation-adjusted expenditures have increased 11 percent. Amidst changes in the national policies affecting the energy industry, the sustained US and Canadian investment summarized in this report supports the value of gas and electric demand side management programs as a cost-effective means of energy resource acquisition and greenhouse gas mitigation.

This report presents trends in 2016 program expenditures and savings and 2017 budgets reported by US and Canadian DSM program administrators, both electric and natural gas. A total of 306 utility and nonutility program administrators operating efficiency programs in all 50 US states, the District of Columbia, and eight Canadian provinces are included in this year's report.[9] While this effort constitutes one of the largest and most comprehensive surveys of program administrators in the United States and Canada and extensive ongoing attention is devoted to data standardization, CEE cautions against making representations and

9 CEE improved the way we track and define response rates starting with the 2014 report. See Section 2.1 for more details on this change. Then, with the 2016 report, CEE streamlined the data collection process, details of which are also provided in Section 2.1.

comparisons beyond those provided in this report. As previously indicated in the Purpose and Limitations and in the Terms of Use, limitations in the comparability and consistency of the data reduce their analytical usefulness below the state or sometimes the regional level. Section 2 clarifies these limitations and outlines the reasons why use of this information at any level—state, regional, national, or binational—should not extend beyond the intended purpose stated above.

1.1 Report Structure

The 2017 State of the Efficiency Program Industry report is divided into eight sections.

- This section, included under the heading of Introduction, provides an overview of the report's scope, key assumptions, and structure.
- Section 2, Data Collection and Limitations, Data Collection and Limitations, describes the report methodology, covering detailed information on data collection methods, survey response rates, and the limitations of the data presented in this report.
- Section 3, Demand Side Management Program Funding in the United States and Canada, presents regional and national data and analysis of natural gas and electric DSM programs.
- Section 4, Evaluation, Measurement and Verification, presents analysis of program expenditures in these areas.
- Section 5, Estimated Program Savings and Environmental Impacts, provides estimated national energy savings data from energy efficiency programs in the United States and Canada. These data are reported by country, fuel type, and customer class.

Appendix A provides a list of the electric energy efficiency program categories used in the 2017 survey and discussed throughout the report.

Appendix B contains tables with electric energy efficiency expenditures by program type for each country, grouped by program category, which are also discussed in Section 3 of the report.

Appendix C contains additional figures regarding electric demand response expenditures in the United States by program type. These figures also expand upon information in Section 3.

Additional data tables that accompany this report present energy efficiency and demand response program expenditures and budgets by state and

province.[10] These tables also present energy savings aggregated and reported at the regional level for the United States and the national level for Canada. CEE does not report savings data by state or province due to the risk of misinterpreting program cost-effectiveness and because of limitations associated with comparing program savings data, which are further explained in Section 2 of this report.

For more information on this report, or to obtain the Annual Industry Report brochure or graphics produced for this report, please visit cee1.org. For members, the report is posted in the CEE Forum.

2 Data Collection and Limitations

This section provides context regarding data collection efforts, in particular participant response rates, program funding, reporting periods, program categories, and exchange rate information. This section also states the limitations of the data required to properly interpret the results of this report.

CEE collected data during the summer and fall of 2017, in conjunction with the American Gas Association (AGA).[11, 12] CEE collected all electric program data while CEE and AGA collaborated to collect gas program data, with AGA collecting the majority of the information. CEE only collected natural gas efficiency information from organizations that are not AGA members, including statewide program administrators. Collaboration with AGA has streamlined data collection and expanded the sample pool of program administrators over the years, and AGA is a major contributor to this report. AGA also publishes additional information on natural gas DSM programs, including a summary of budgets and expenditures as reported here, energy savings data, information on program implementation and evaluation, and regulatory information. Please contact AGA directly for more on these publications, which are available on their website.

10 These tables are available at http://www.cee1.org/annual-industry-reports.

11 The American Gas Association, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States. There are more than 73 million residential, commercial, and industrial natural gas customers in the United States, of which 95 percent—over 69 million customers—receive their gas from AGA members. AGA is an advocate for natural gas utility companies and their customers and provides a broad range of programs and services for member natural gas utilities, pipelines, marketers, gatherers, international natural gas companies, and industry associates. Today natural gas meets more than one-fourth of the United States' energy needs. To find out more, please visit www.aga.org.

12 CEE began collaborating with AGA in 2009 to increase the report's coverage of natural gas programs.

CEE administers this survey annually via an online survey[13] to a variety of DSM program administrators, including investor-owned utilities, nonutility program administrators, municipal power providers, and co-ops. The survey frame included previous survey respondents, all member organizations of AGA and CEE,[14] nonmembers who were expected to have significant DSM programs, and some program administrators who submitted data to the Energy Information Administration (EIA).[15] Due to the constantly changing nature of the DSM industry, it is difficult to identify and survey every program administrator. Despite this challenge, CEE has continuously worked to make its sample frame as representative of the current industry as possible.

2.1 Response Rates

Data for this report come from a voluntary survey administered to program administrators in the United States and Canada. Because responding organizations may vary by state or province from year to year, caution should be used in comparing data and inferring trends, especially at the state or provincial level. Despite numerous attempts to follow up, not all organizations included in the sample frame respond to the survey each year. Thus, year–to-year changes in the data reported here cannot be entirely attributed to new or expanded programs and new program administrators. Where appropriate, the analyses below includes comparisons of only those respondents who provided information in both 2016 and 2017, alongside the analyses of all data collected.

In 2013, CEE began asking respondents to provide public regulatory documents, program plans, and implementation or evaluation documents in the survey. This has allowed us to verify information provided by survey respondents and, in some cases, to update inaccurate information or to supplement what we received with public data not provided in the survey. Most importantly, these supplemental documents have allowed CEE to uncover unreported information for program administrators who we expected to have significant DSM budgets, expenditures, or savings.

13 The electric survey collects information about demand response programs, but the natural gas survey does not because comparable demand response programs do not exist for natural gas.

14 CEE members include electric and natural gas efficiency program administrators from across the United States and Canada. For more information on CEE membership, please visit www.cee1.org/content/members.

15 There are many community-owned electric utilities operating efficiency programs in the United States that are not included in this report. The American Public Power Association (APPA) is a nonprofit organization created to serve the nation's more than 2,000 community-owned electric utilities that collectively deliver power to more than 49 million Americans. For more information about APPA or its members, please visit www.publicpower.org.

In 2017, this report reflects data for 306 utility and nonutility program administrators operating DSM programs in 50 US states, the District of Columbia, and eight Canadian provinces. These figures include those organizations accounted for using the streamlined analysis described in the next section.

This total also takes into account adjustments made last year when CEE and AGA worked together to correct a categorization error. Nonresponsive organizations were mistakenly incorporated in the responding organization total. Correcting this error reduced the total from 361 to 321 organizations. This year an additional adjustment corrected an inflated organization count resulting from a categorization error associated with the streamlined survey process instituted last year, which further corrected last year's total from 321 to 308 organizations. After accounting for these changes, this 2017 report describes budget, expenditure, and impact information for two fewer respondents than in 2016. As in the past, CEE concludes that this report represents the vast majority of large efficiency program administrators and that the data provided below sufficiently represent the DSM industry in 2016 and 2017.

2.2 2016 Data Collection Methodology Change

In 2016, in an effort to streamline the survey process and reduce the survey burden on respondents, CEE staff prioritized outreach to those electric program administrators that represent the majority of industry expenditures. For numerous smaller or historically unresponsive program administrators, information from the Energy Information Administration (EIA)[16] or responses provided in a previous survey year, adjusting for exchange rates and inflation, as appropriate, were incorporated. The organizations for which CEE substituted EIA information represent less than twelve percent of total US and Canadian electric DSM expenditures in 2017, and smaller organizations for which CEE carried through information represent less than four percent of total electric expenditures. This process did not impact the US and Canadian natural gas results. In addition, similar to past years, CEE carried over information from the previous year for a couple large program administrators that did not respond in 2017, so as to estimate program activity rather than allow totals for these administrators to fall to zero. Large organizations for which CEE carried through previously provided information account for

16 Data from the 2016 EIA Form 861 collection effort are available at "Electric power sales, revenue, and energy efficiency Form EIA-861 detailed data files," US Energy Information Administration, http://www.eia.gov/electricity/data/eia861/.

roughly four percent of US and Canadian natural gas expenditures, and did not impact US and Canadian electric expenditures.

2.3 Funding Sources

In previous survey years, CEE asked respondents to provide budget and expenditure figures from ratepayer funded sources, as well as to list other sources of funding in the survey. Respondents often listed other sources, such as the American Recovery and Reinvestment Act (ARRA), without providing any supporting data figures to indicate the significance of the additional funding. In 2013, CEE began asking electric survey respondents to report budget and expenditure figures using specifically defined categories that included both ratepayer and nonratepayer sources. In 2014, CEE and AGA also began asking gas survey respondents to report additional funding from nonratepayer sources.[17] These changes were intended to improve the consistency and clarity of survey terminology and reporting categories, as well as to obtain a more comprehensive picture of the industry's financial landscape and identify the relative magnitude of funding from sources other than ratepayers.

CEE defines ratepayer funds as dollars secured through special regulator-approved benefit or on-bill tariff charges that are universally collected as supplemental charges to energy bills.[18] CEE defines nonratepayer funds as funds received from sources such as wholesale capacity market revenues, the Regional Greenhouse Gas Initiative (RGGI) proceeds, and dollars specifically allocated to weatherization assistance programs. As of 2015, CEE no longer asks respondents to report funds dispersed from the American Recovery and Reinvestment Act (ARRA), as no ARRA funds were reported in 2014 and we do not believe any significant sources of these funds exist at this point.

In this report, we disclose total figures that represent all funding sources in charts and graphs depicting historical trends. Where appropriate, the text specifically notes the percentage of 2017 budgets and 2016 expenditures and savings attributable to ratepayer funds only.

17 Only natural gas program expenditures and savings derived from ratepayer dollars are identified in this report. In all, gas program administrators reported that 99.9 percent of expenditures in 2016 were made using ratepayer funding. One hundred percent of natural gas savings reported to CEE and AGA were presumably derived from ratepayer funding. Section 3.2, below, addresses nonratepayer sources of funding in 2017 budgets.

18 More specifically, CEE clarified in the 2017 survey that ratepayer funds include "funds derived from system benefit charges, bill surcharges, utility revenues, budget carryover, and transfers from other program administrators that derive funds from any of the above."

2.4 Reporting Period

CEE asked respondents to provide data representing total program budgets for 2017 and total program expenditures and savings for 2016 that aligned with calendar years. CEE defined the budget year for this survey effort as beginning on January 1, 2017 and ending on December 31, 2017. Similarly, CEE defined the "expenditure and savings year" for this survey effort as beginning on January 1, 2016 and ending on December 31, 2016.

In some cases, respondents indicated that their organization reporting cycles did not align with calendar years and that figures reported were not adjusted accordingly. In these cases, CEE requested supplemental information regarding the specific start date and end date for annual budget figures and annual expenditures figures. CEE did not adjust their reported annual figures to align with the calendar year reporting cycle, however. Therefore, please note that some portion of the 2017 industry budget figures and some portion of the 2016 expenditures and savings figures may include data that fall outside of the January 1 to December 31 reporting cycle. Any year identified in this report should be taken to mean the associated program year for all program administrators.

2.5 Reporting Categories

This publication groups data into customer classes, as in previous years. Electric customer classes in 2017 include residential, low income where separable from residential; commercial, industrial, commercial and industrial (C&I) where commercial and industrial were not separately reported or distinguishable; cross sector; and demand response. Since 2013, the category of evaluation, measurement and verification (EM&V) used in previous reports is included as part of the cross sector class, which covers activities that span multiple customer classes. Customer classes in gas data include residential, low income where separable from residential; multifamily where separable from residential and commercial; commercial, industrial, C&I where commercial and industrial were not separately reported or distinguishable; and other.

In 2013, CEE introduced more granular categories within each electric customer class. The categories used in 2013 were adapted, with a few minor changes, from a typology developed through another national research effort.[19] CEE has incorporated questions into the survey that ask respondents

19 Hoffman, Ian M., et al. "Energy Efficiency Program Typology and Data Metrics: Enabling Multi-state Analyses Through the Use of Common Terminology," Lawrence Berkeley National Laboratory, August 2013, http://emp.lbl.gov/sites/all/files/lbnl-6370e.pdf.

to report budgets, expenditures, and impact data by program type if possible.[20] In 2017, as in the three previous survey years, CEE also allowed respondents to provide rough percentage breakdowns of their budgets, expenditures, and impacts by program category, even if they could not provide exact dollar or MWh figures for programs. These changes aim to provide more specific information regarding the types of electric programs administered in the United States and Canada and allow for a more nuanced understanding of program offerings moving forward. See Appendix A for a list of the program categories used consistently since 2014.

As in past years, CEE based demand response program categories on those specified and defined by the US Federal Energy Regulatory Commission (FERC).[21] FERC defines several demand response program types and groups them into two major categories: "incentive-based programs," which tend to involve customer contracts with utilities to curtail load when necessary, and "time-based programs," which generally employ graduated pricing schemes that motivate customers to reduce load during system peaks.

Highlights of collected program data are presented in the appropriate sections below, but these data only represent respondents who chose, or were able, to provide information broken out into the specified program categories. The survey asked respondents who could not report at this level of granularity to break their budgets, expenditures, and savings into customer classes only.

The "not broken out" category includes respondent data not further divided into customer classes. These data appear in the binational and national aggregated totals and charts in this report but, by definition, are not included in the analysis of data by customer classes or program types.

2.6 Other Data Limitations

CEE makes every attempt to collect data that align with the definitions and data requirements outlined in the terminology section of the survey. When staff members identify outlying values in the data, we contact respondents and work with them to obtain accurate information. Furthermore, we believe that improvements resulting from the switch to an online survey format have reduced errors over the past several years.

20 CEE has incorporated program level questions for the electric survey only. CEE will continue work with our members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

21 CEE sourced demand response terminology from the "2012 Assessment of Demand Response and Advanced Metering: Staff Report," Federal Energy Regulatory Commission, https://www.ferc.gov/legal/staff-reports/12-20-12-demand-response.pdf, December 2012.

With regard to budgets, considerable room exists for reporting error, and such errors are not always apparent. "Cycle budgets" provide a prime example and are discussed in more detail in Section 3.3. Annual budgets in this report also present limitations, as they illustrate a snapshot from within the data collection period, whereas expenditures and savings from the previous year have often been finalized by the time the survey is fielded.

The data in this publication do not reflect changes to program budgets after the fall of 2017, such as those due to newly approved programs or budget cuts. In addition, carryover of unspent funds from 2016 could result in double counting. In light of the caveats outlined above surrounding annual budgets, this report follows previous ones and focuses on expenditures rather than budgets as the best indicator of energy efficiency program industry investment.

Finally, several issues limit the comparability of data—in particular the savings data—across the United States and Canada. These include, but are not limited to, variations in regulatory requirements or program administrator practices for reporting performance data; differences in the interpretation of the terms used in the survey even when standard definitions are provided; differences in accounting practices among program administrators; variations in formulas used to estimate gross and net program savings; and differences in the focus or goals of programs, which often affect the tracking and reporting of different performance data.

Each regulatory jurisdiction provides specific policies for program administrators in that jurisdiction, which can lead to different assumptions and methods for cost-benefit tests, net-to-gross factors, savings equations, avoided transmission and distribution system line losses, measure persistence, and incremental savings reporting between states and provinces. For example, some program administrators may only account for incremental savings resulting from installation of efficient equipment using existing codes as a baseline, whereas others are allowed to account for savings using the efficiency of the replaced equipment as a baseline. These different baseline assumptions may lead to significant variations in the savings claimed by different program administrators for the same efficient equipment in the same replacement scenario. CEE believes that for these reasons, savings data in particular should only be aggregated at the US census region level in the United States and at the national level in Canada.

2.7 Currency Conversions and Corrections for Inflation

For ease of reading, all currency is reported in nominal US dollars (USD) unless otherwise specified. Where used, Canadian dollars (CAD) are also nominal unless otherwise specified. Real US dollars were calculated using the Bureau of Labor Statistics CPI Inflation Calculator,[22] and real Canadian dollars were calculated using the Bank of Canada CPI Inflation Calculator.[23] This report uses an average annual exchange rate of 0.7551 USD = 1 CAD for the 2016 expenditure and savings information (an average of the daily Federal Reserve[24] exchange rate for January 1, 2016 – December 31, 2016) and an average annual exchange rate of 0.7488 USD = 1 CAD for the 2017 budget information (an average of the daily Federal Reserve exchange rate for January 1, 2017 – May 31, 2017).

2.8 Corrections to 2016 Data

Please note that while CEE staff review respondent information in order to adjust expenditures and savings appearing in this report where respondents subsequently corrected their 2016 survey responses, no such changes were made in 2017.

3 Demand Side Management Program Funding in the United States and Canada

3.1 Combined DSM Budgets in the United States and Canada

US and Canadian electric and gas DSM program budgets—including both energy efficiency and demand response programs from all surveyed sources—reached just under $9.9 billion in 2017, representing an increase of seven percent from 2016 (Figure 1).[25] This change reverses relative decreases seen in 2015 and 2016, and returns the binational DSM program budget total to just under its 2014 level, which was the highest total seen over the history of this

22 "CPI Inflation Calculator," Bureau of Labor Statistics, accessed March, 1, 2018, http://www.bls.gov/data/inflation_calculator.htm.

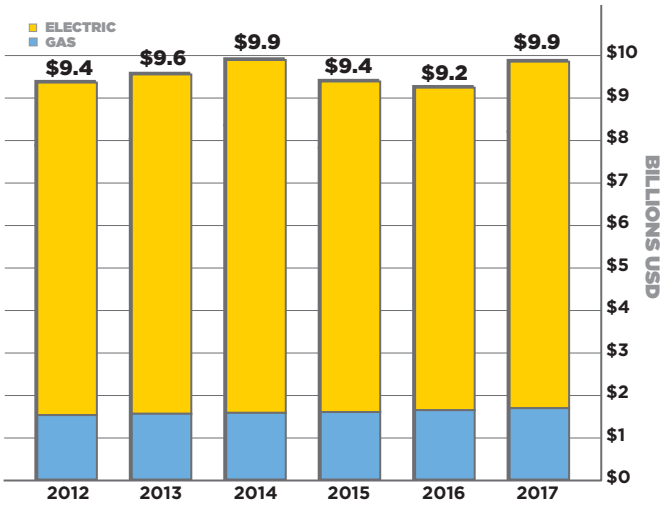
23 "Inflation Calculator," Bank of Canada, accessed March, 1, 2018, http://www.bankofcanada.ca/rates/related/inflation-calculator/.

24 "Canadian Spot Exchange Rate, Canadian $–US$," last modified March, 1, 2018, http://www.federalreserve.gov/releases/h10/Hist/.

25 Percentage changes in combined US and Canadian data are not adjusted for inflation. Data are adjusted for inflation for each individual country, however, and are identified throughout the report.

report. In nominal dollars, 2017 US electric and gas program budgets increased by eight and three percent respectively over 2016, while Canadian electric budgets were stable and Canadian gas budgets experienced a slight decrease of less than one percent. After adjusting for inflation, US electric budgets increased five percent compared to 2016, US gas budgets were stable, and Canadian electric and gas budgets decreased by two and three percent respectively.

Figure 1 US and Canadian DSM Program Budgets—Gas and Electric Combined 2012–2017



Budgets derived exclusively from ratepayer funds accounted for 96 percent, over $9.4 billion, of the total 2017 budget figure. Figure 1 does not isolate demand response budgets, though in 2017 they represent approximately nine percent of both the total DSM budgets from all sources, about $874 million, and the ratepayer funded DSM budgets, about $870 million. From 2012 to 2015, the percentage of both the total and ratepayer funded DSM budget figures allocated to demand response programs steadily decreased, dropping from 14 percent to 10 percent, though that percentage has remained essentially stable from 2015 to 2017.

3.2 Funding Sources

In 2017, ratepayer dollars constituted 95.76 percent of funding for electric DSM programs in the United States. Remaining sources of funding included the wholesale capacity markets (2.00 percent), the Regional Greenhouse Gas Initiative (1.50 percent) and the Weatherization Assistance Program (0.02 percent), in addition to unidentified sources (2.99 percent). Regional Greenhouse Gas Initiative (RGGI) funding constituted four percent of the total funding reported in the RGGI states, down from seven percent in 2016 and

2015, and close to the three percent RGGI funding represented in these states in 2014.

In 2017, ratepayer dollars constituted 99.98 percent of funding for natural gas energy efficiency programs in the United States. The remaining 0.02 percent was derived from unidentified sources.

In 2017, 100 percent of Canadian funding for both electric and natural gas DSM programs came from ratepayer funding.

3.3 Continued Program Funding

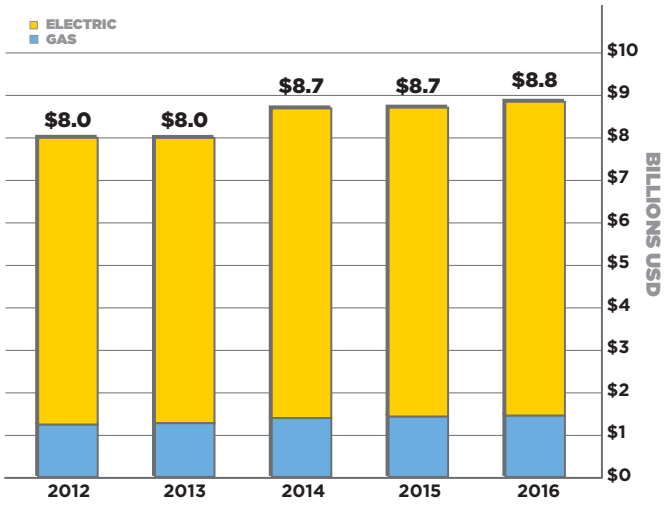
Since 2013, CEE has asked program administrators to report multiyear budgets, referred to in the survey and this report as "cycle budgets," that provide a glimpse into funding that has been set aside for DSM programs over the next several years. This is primarily a quality assurance procedure in that it allows CEE to verify that budgets for individual program years are not arbitrarily overreported and to estimate single-year budgets when program administrators do not allocate funds on an annual basis. In addition, because DSM activity may ramp up at the beginning of a cycle and down at the end of a cycle, this information explains—and anticipates—certain trends.

Roughly 40 percent of cycle budgets reported in this year's survey extend past the end of 2017—44 percent end in 2017, 16 percent in 2018, and 24 percent in 2019 or after. Approximately 60 percent of the cycle budgets reported were for only one year or, if they were for multiple years, ended in 2017. Although procurement plans for supply-side energy resources may extend several decades into the future, this signifies that multiyear planning is also integral to DSM activity. Furthermore, in some areas, such as the Pacific Northwest and more recently California, DSM is already anticipated in resource plans spanning a decade or more.

3.4 Combined DSM Expenditures in the United States and Canada

DSM expenditures of US and Canadian program administrators incorporated in this year's survey totaled $8.8 billion USD in 2016, an increase of two percent over 2015, including $8.5 billion in expenditures from ratepayer funds, an increase of three percent compared to 2015. The real difference between 2015 and 2016 is similar, with total DSM expenditures increasing just under one percent from all sources and ratepayer funded programs remaining stable when inflation is taken into account. Figure 2 below illustrates the historic trend of combined US and Canadian DSM expenditures over the years.

Figure 2 US and Canadian DSM Program Expenditures—Gas and Electric Combined 2012–2016



Although not isolated in Figure 2, demand response expenditures represent 12 percent of total expenditures in 2016 regardless of funding source. This is approximately one percent more than the proportion of total DSM expenditures spent on demand response in 2015, 11 percent, though still less than the proportion spent on demand response from 2012 to 2014, when demand response accounted for between 13 and 14 percent of total DSM program expenditures. This increase in the proportion of DSM expenditures spent on demand response is counter to the slight decrease seen in demand response budgets, though both suggest that DR represents a similar proportion of overall DSM spend, between 10 and 12 percent.

CEE has previously noted that increases in the number of survey respondents year after year could explain some of the historical growth in budgets, expenditures, and savings.[26] As explained in Section 2.1, Response Rates, despite our best efforts, Figure 2 does not depict expenditures year after year from the exact same pool of survey respondents.[27] However, the streamlined survey process described in Section 2.1, whereby 2016 and 2017 electric responses were supplemented with other information sources, in part resulted in an exceptionally similar pool of electric program administrators between the

26 Please note that as the CEE survey panel now contains most large program administrators in the United States and Canada, CEE believes that since 2012, the panel of survey respondents targeted each year for data is representative of DSM industry at large. Therefore, CEE believes that increases due to new respondents no longer have a large impact. However, the effects of a "large" respondent not participating in subsequent years could potentially cause notable variation.

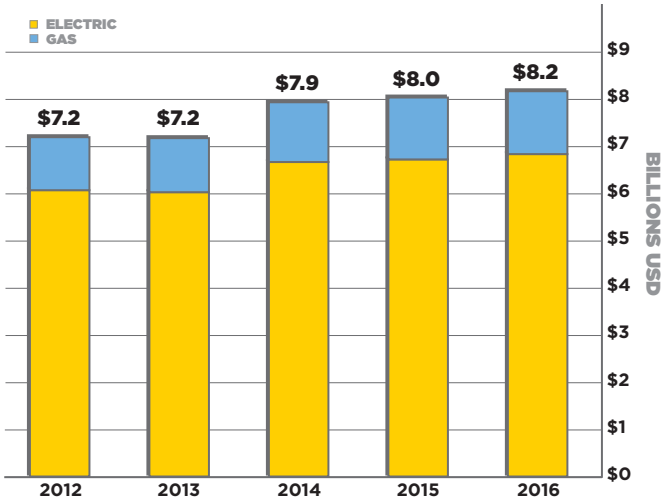
27 As stated in Section 2.1, where appropriate, CEE will provide supplemental analyses that include comparisons of only those respondents who provided information in both 2016 and 2017, alongside the analyses of all data collected, because responding organizations may vary from year to year. Thus, the year-to-year changes in the historical trend graphs cannot be entirely attributed to new or expanded programs and to new program administrators.

2015, 2016, and 2017 survey years. Therefore, where it is deemed more accurate throughout this report, year-over-year comparisons between respondents in the 2016 and 2017 survey years exclude information derived from sources other than a completed CEE or AGA survey response, such as EIA data or information carried through from a previous response. When strictly comparing survey respondents in the United States and Canada who participated in both the 2016 and 2017 surveys, expenditures were nearly stable, only down 0.28 percent.[28] Reported DSM budgets from respondents in both years were up 6.99 percent in 2017 compared to 2016, and so despite slight differences, these comparisons indicate continued expenditures in the energy efficiency program industry beyond the effects of drop-offs or new respondents between the 2016 and 2017 survey years.

3.5 United States DSM Trends

US administrators spent nearly $8.2 billion[29] from all sources for gas and electric DSM programs in 2016. As shown in Figure 3, this total includes both energy efficiency and demand response.

Figure 3 US DSM Expenditures—Gas and Electric Combined 2012–2016



2016 gas and electric DSM expenditures in the United States increased two percent over 2015 expenditures in nominal dollars, one percent when adjusted for inflation. Over the past five years, US inflation-adjusted DSM expenditures have increased six percent. When comparing only those program

28 Survey respondents that provided both 2015 and 2016 expenditure data spent $21.6 million more on DSM programs in 2015 than in 2016.

29 $7.8 billion of these expenditures were derived solely from ratepayers, an approximately four percent increase from 2015 in nominal dollars, three percent when adjusted for inflation.

administrators who responded to both the 2016 and 2017 surveys, expenditures from all sources increased by over $78 million, or 0.96 percent.

The $8.2 billion spent by US DSM program administrators represents 0.04 percent of 2016 US gross domestic product and 2.79 percent of the value added by the US utility industry to gross domestic product in 2016. DSM expenditures were closest in scope to the value added by the "apparel and leather and allied products" industry, $9.66 billion.[30]

Although not depicted in Figure 3, in 2017, natural gas and electric DSM program administrators in the United States budgeted nearly $9.1 billion from all sources, representing an increase of four percent as compared to 2016 when adjusted for inflation.

3.5.1 United States Electric DSM Trends

In 2016, US program administrators spent over $6.8 billion on electric DSM programs, a 1.67 percent increase compared to 2015 expenditures, an increase of approximately half a percent when accounting for inflation.[31,32] Figure 4 presents the breakdown of US electric expenditures from 2012 to 2016 by customer class, which represents the sum of either program level data rolled up to customer classes or customer class data provided directly by respondents. "Not broken out"[33] contains data that program administrators could not allocate to a specific program or customer class.

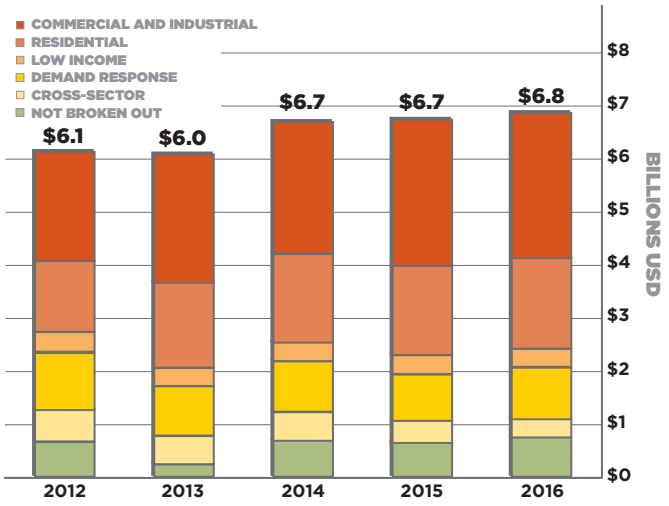
30 Comparisons in this paragraph are based on data from the US Department of Commerce Bureau of Economic Analysis: https://www.bea.gov/iTable/index_industry_gdpIndy.cfm, Most recent update: November 2, 2017.

31 In 2016, $6.7 billion of the total expenditures were derived solely from ratepayer funds. When adjusted for inflation, this represents an increase of three percent compared to the proportion of expenditures from ratepayers in 2015. In 2015, 92.6 percent of expenditures came from ratepayer funds, and in 2016, 95.1 percent of expenditures were derived from ratepayer funds.

32 Inflation adjusted figures were based on the "CPI Inflation Calculator," Bureau of Labor Statistics, accessed March 2018, https://www.bls.gov/data/inflation_calculator.htm.

33 Please note that the "not broken out" class was added in 2011 to capture any expenditure figures that could not be allocated to individual customer classes, which in some cases includes overall portfolio activities such as EM&V or administration and marketing.

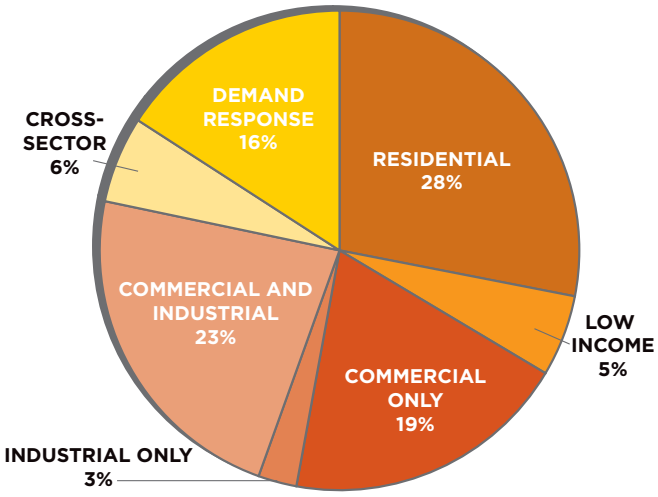
Figure 4 US Electric DSM Expenditures 2012-2016



Notably, in 2016 "cross sector" expenditures decreased by 20 percent, and the share of "not broken out" expenditures increased by 16 percent relative to 2015. Both of these changes are primarily driven by a single large program administrator that was unable to break out 2016 expenditures, increasing the "not broken out" category and diminishing the share represented by the other categories. Residential and demand response spending both increased in 2016 by two and eleven percent respectively, while commercial and industrial spending remained stable. Low income spending saw a decrease of five percent relative to 2015 expenditures.

Figure 5 provides a more granular breakdown of 2016 US electric expenditures from all sources by customer class, with the "not broken out" class removed and with commercial and industrial spending separated into commercial, industrial, and C&I classes. Continuing the trend from previous years, the data illustrate that commercial and industrial efficiency programs received the largest share of electric program funding in the United States, comprising 45 percent of 2016 US electric DSM expenditures consistent with 2015. The residential sector received the second largest share of 2016 DSM electric expenditures, 28 percent, also consistent with 2015. Demand response maintained a sizable portion of expenditures at 16 percent, a two percent increase from 2015, followed by cross-sector, at six percent, a one percent decrease, and low income programs, five percent, a one percent decrease.

Figure 5 2016 US Electric DSM Expenditures by Customer Class



CEE also collected information on expenditure (cost) categories for electric energy efficiency programs, as depicted in Figure 6.

Figure 6 2016 US Electric Energy Efficiency Expenditures by Category

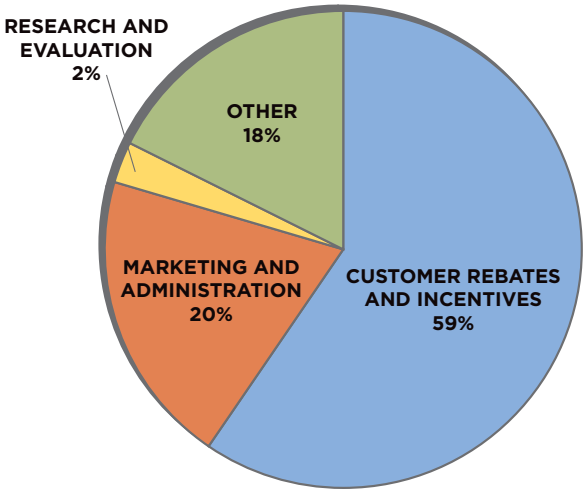


Figure 6 provides an overview of how US program administrators currently allocate electric energy efficiency program expenses, regardless of the targeted customer class. As in the past four years, customer rebate and incentive costs, sometimes classified as direct program costs, represented over half of US electric energy efficiency expenditures in 2016 and are up four percent compared to 2015. Marketing and administration costs—often referred to as indirect program costs—represented 20 percent of 2015 energy efficiency program expenditures in the United States, a four percent lower proportion

than in 2015. The "other" category—making up 18 percent of 2016 US electric expenditures—contains all funds that US program administrators could not separate into one of the other three categories.

Although not depicted in Figure 6, US program administrators who responded to the survey in both 2016 and 2017 spent roughly 97 percent of the ratepayer funds that were budgeted for electric DSM in 2016. This percentage is slightly greater than the 93 percent of budgeted ratepayer funds spent among US program administrators that responded to the survey in both 2016 and 2015, and substantially greater than the 73 percent and 85 percent spent between the 2015 and 2014, and 2014 and 2013 surveys, respectively.

3.5.2 United States Program Level Electric DSM Expenditures

Since 2013, CEE has incorporated questions into the US electric survey that ask respondents to report budgets, expenditures, and impact data at the program level when possible.[34] (Please refer to Section 2.4 for more details on program types.) By collecting electric expenditures by program category, CEE intends to track and provide information to help better understand changes or trends in program offerings.

Of the 122 US electric program administrators who participated in the 2017 electric survey, 91 percent provided energy efficiency or demand response expenditures for the program types listed. When data reported for these program types are aggregated by customer class, they indicate an expenditure breakdown similar to that in Figure 5, which represents all 2016 expenditure data reported in the 2017 survey and includes expenditures from the remaining nine percent of electric DSM program administrators that did not break out their information at the program level. Therefore, we conclude that the programmatic energy efficiency data we obtained in 2016 are representative of overall US electric expenditure trends.

Figure 7 lists the most common energy efficiency program types in terms of expenditures; these programs represent 39 percent of all the programmatic energy efficiency expenditures reported by respondents. Demand response program expenditures are not listed in the body of this report but are discussed in general in Appendix C.

34 Only electric respondents were asked to break their program expenditures down by the provided program typology. CEE will continue to work with members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

Figure 7 Most Common US Electric Energy Efficiency Program Types by 2016 Expenditures

CUSTOMER CLASS	PROGRAM TYPE	2016 EXPENDITURES
COMMERCIAL AND INDUSTRIAL	MIXED OFFERINGS	$560,032,277
LOW INCOME	-	$331,144,219
RESIDENTIAL	CONSUMER PRODUCT REBATE FOR LIGHTING	$244,220,441
COMMERCIAL AND INDUSTRIAL	CUSTOM	$214,962,376
COMMERCIAL AND INDUSTRIAL	PRESCRIPTIVE	$200,723,641
COMMERCIAL	SMALL COMMERCIAL PRESCRIPTIVE	$193,282,914
COMMERCIAL	GOVERNMENT, NONPROFIT, MUSH	$175,101,546

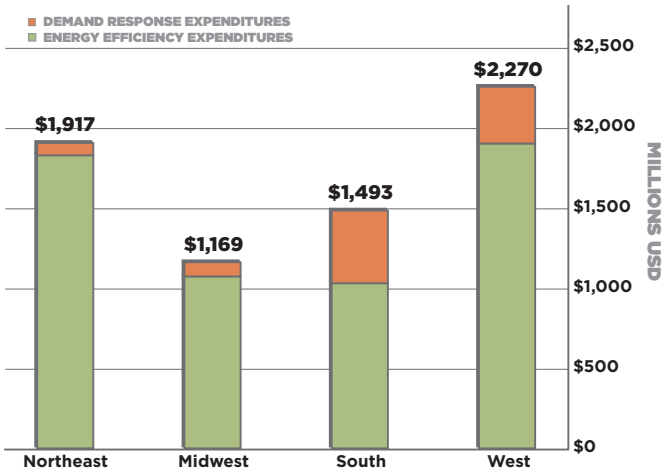
As compared to 2015 program expenditures, Figure 7 indicates that survey respondents reported an increased amount of spending on commercial and industrial mixed offering programs for the third year in a row, as 2016 expenditures in this category were six percent higher than in 2015, which was 20 percent higher than in 2014. Consistent with previous years, prescriptive and custom programs in the commercial and industrial classes constitute a significant portion of the program category expenditures provided, as do low income and residential lighting programs. New this year, 2016 residential home retrofit programs (down nine percent) were removed from the list, replaced by commercial and industrial custom programs (down one percent). For a full disclosure of the US electric energy efficiency program expenditures provided by survey respondents, please refer to Appendix B.

3.5.3 United States Electric Demand Response Expenditures

Approximately 65 percent of electric program administrators who reported 2016 energy efficiency program expenditures also provided demand response expenditures, which suggests that the majority of US electric survey respondents continue to administer both energy efficiency and demand response programs. Demand response expenditures represent 16 percent of US electric DSM expenditures in 2016 (see Figure 5), an increase of two percent compared to 2015. Demand response expenditures increased by 11 percent compared to 2015 in nominal dollars, 10 percent when accounting for inflation. These increases were driven primarily by substantial increases in reported spending from two large program administrators, though overall 60 percent of program administrators reporting demand response expenditures noted increases.

Figure 8, provides a regional snapshot of DSM expenditures in the United States in 2016, separated into energy efficiency and demand response.

Figure 8 US Electric Energy Efficiency and Demand Response Expenditures by Region, 2016



The South and West continue to lead in demand response expenditures. Data indicate that the South represents the highest proportion of demand response expenditures in 2016 (47 percent), followed by the West (36 percent), Midwest (nine percent) and Northeast (eight percent). This regional breakdown is similar to 2015, and no region's share shifted by more than three percent. That said, all regions saw increases in demand response expenditures. The Northeast experienced the greatest relative growth, increasing by 73 percent and $33 million additional spend. This significant increase was nearly entirely driven by additional demand response spending at a single program administrator.[35] The South saw the largest increase in spend, $55 million, a 14 percent increase compared to 2015. The West and Midwest followed, increasing by $14 and $7 million (four and nine percent) respectively.

In 2013, CEE modified the demand response program categories to align with those used by FERC. (See Section 2.4 for more information.) FERC defines several demand response program types and groups them into two major categories: "incentive-based" programs and "time-based" programs. Appendix C contains charts and supporting information regarding these two categories of demand response programs.

35 The program administrator driving this change responded to last year's survey, but their information this year is based on EIA data. While it is possible that this increase is at least in part attributable to differences in how the program administrator reported to each organization, CEE has intentionally designed its survey to align with EIA data definitions so as to mitigate arbitrary reporting errors with supplemented information such as this.

3.5.4 United States Natural Gas Trends

This section discusses natural gas energy efficiency program expenditures in the United States.[36] Figure 9 shows that gas program expenditures for energy efficiency programs in the United States were essentially stable in 2016. US gas program administrators spent $1.30 billion on natural gas efficiency programs in 2016, which represents a one percent increase over 2015 expenditures, but a less than one percent decrease after accounting for inflation. This represents a ten percent increase over 2012 when adjusted for inflation.

Figure 9 US Natural Gas Expenditures 2012-2016

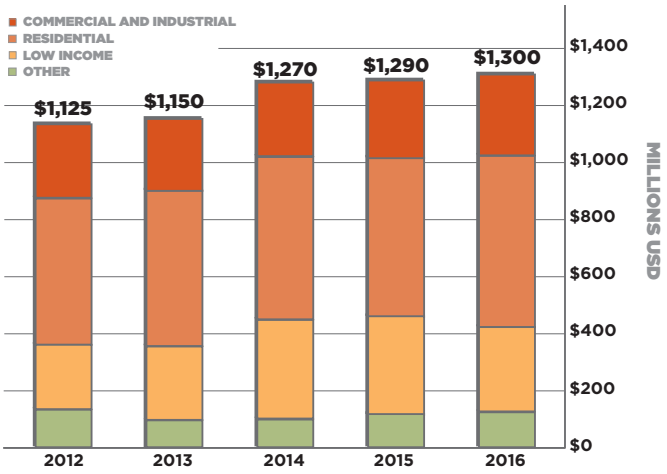


Figure 9 presents the magnitude of expenditures from 2012 to 2016 by customer class.[37] The customer class breakdown of 2016 natural gas expenditures is similar to that of 2015 expenditures for most categories. Residential programs continue to represent the largest share of expenditures in 2016 at 41 percent, up two percent from 2015. Low income and C&I programs follow, accounting for 23 percent (down four percent) and 22 percent (up one percent) of expenditures respectively. "Other" expenditures also represented a higher share of US natural gas spend in 2016, nine percent, up four percent from 2015.

Figure 10 provides a more granular breakdown of 2016 US gas expenditure by customer class. For ease of comparison with previous reports and with a concurrent report by AGA, we did not break commercial and industrial into

36 Please note that natural gas programs are only energy efficiency programs. Natural gas demand response programs do not exist within the industry.

37 For ease of year-to-year comparison, note that Figure 9 combines the commercial and industrial customer classes into one commercial and industrial category, as well as the residential and multifamily customer classes into one residential category, for 2013 through 2016.

separate classes in Figures 9 and 10, but multifamily expenditures are separated from residential expenditures in Figure 10.

Figure 10 2016 US Natural Gas Expenditures by Customer Class

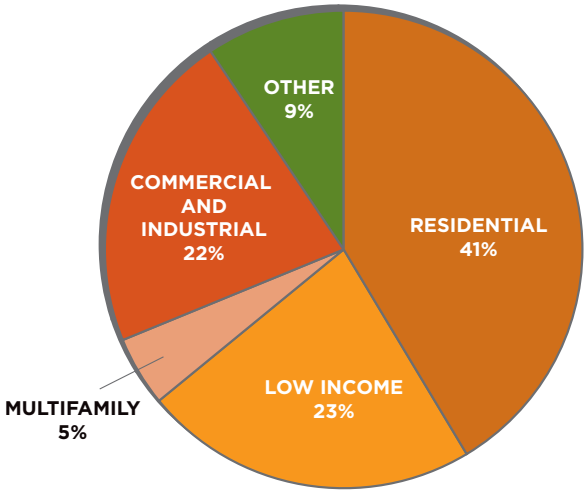
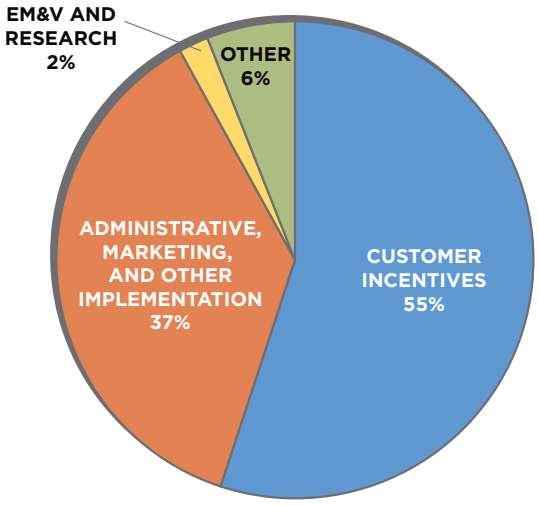


Figure 11 separates 2016 gas expenditures in the United States into expenditure categories, which are slightly different from the categories used for US electric programs.[38]

Figure 11 2016 US Natural Gas Expenditures by Category



Customer incentives represented more than half of expenditures in 2016 (55 percent) followed by administrative, marketing, and other implementation spending (37 percent). Research, evaluation, measurement, and verification accounted for two percent of the spending, while "other" expenditures

38 The electric and gas surveys request this information in ways that are similar, though not identical.

accounted for six percent of spending. The "other" category contains all funds that could not be separated into the three specific categories. This breakdown is consistent with the previous year's spending allocations.

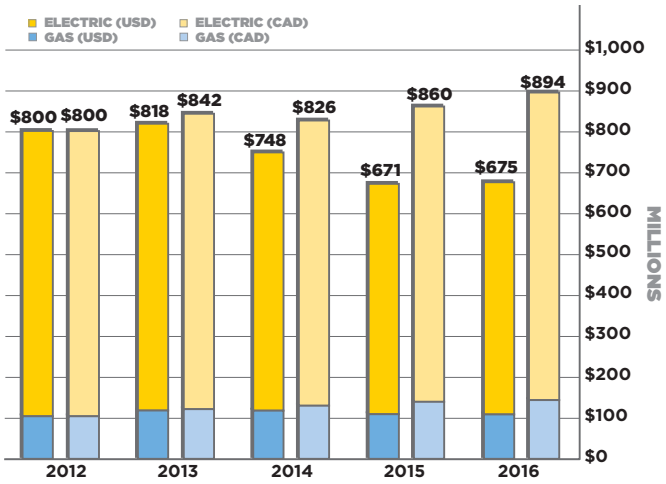
Although not depicted in Figure 11, US natural gas program administrators budgeted $1.56 billion for natural gas efficiency programs in 2017, which represents an increase of three percent from 2016 budgets, less than one percent when accounting for inflation. Considering just those program administrators who responded to the survey in both 2015 and 2016, programs spent 91 percent of the funds that were budgeted for natural gas programs in 2016.

3.6 Canadian DSM Trends

In 2016, Canadian DSM expenditures increased to $675 million USD. This change overcomes a weakening of the Canadian dollar relative to the US dollar in recent years, as CAD expenditures rose for the second year in a row to $894 million in 2016. In USD, this represents a one percent increase in expenditures as compared to 2015, a decrease of less than two percent after adjusting for inflation.[39] In CAD, 2016 represents a four percent increase in expenditures as compared to 2015, or two percent when adjusting for inflation. Figure 12 presents Canadian DSM expenditures—including both energy efficiency and demand response programs—from 2012 to 2016 in nominal US and Canadian dollars. In addition, a Canadian electric program administrator reported information for the first time in several years, contributing to the overall increase shown from 2015 to 2016. That said, across Canadian gas and electric program administrators, the majority reported decreases in 2016, though these were overcome by reported increases, primarily from the single program administrator mentioned. Overall, Figure 12 illustrates that after a few years of stability, Canadian gas and electric DSM expenditures have begun to increase moderately over the past two years, suggesting consistent investment in the efficiency industry.

39 All Canadian program administrators reported 100 percent ratepayer funded expenditures in the 2017 survey.

Figure 12 Canadian DSM Expenditures—Gas and Electric Combined (2012–2016)



The $894 million CAD spent by Canadian DSM program administrators represents 0.05 percent of 2016 Canadian Gross Domestic Product and two percent of value added by the Canadian utility industry in 2016. DSM expenditures were most comparable to the value added by the "foundries" industry ($932 million in 2016 Canadian dollars) and higher than the value added by the "tobacco manufacturing" industry ($857 million in 2016 Canadian dollars).[40]

In 2017, reporting natural gas and electric DSM program administrators in Canada budgeted nearly $758 million, or just over $1.01 billion CAD, to energy efficiency and demand response programs. In USD, this represents a stable level compared to 2016 DSM budgets, and a less than one percent increase in CAD.

3.6.1 Canadian Electric DSM Trends

CEE reports electric DSM trends by customer class and, as discussed in previous sections, asks survey respondents to report budgets, expenditures, and impact data at the program level when possible.[41] Respondents who were able to provide these data were asked to select a specific program type for each program (see Section 2.4 and Appendix A for more information); CEE

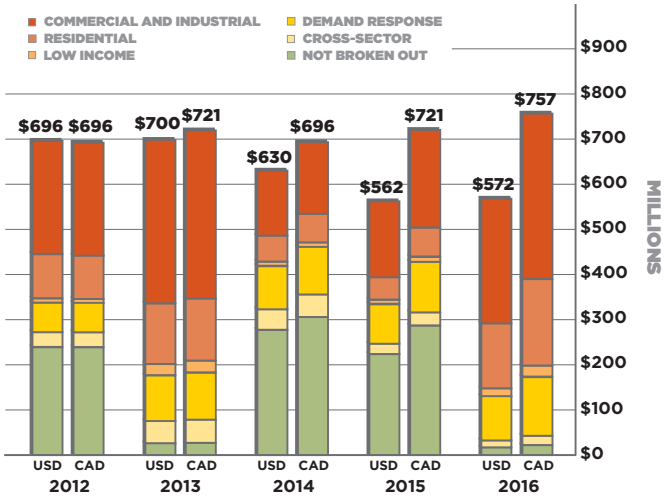
40 Comparisons in this paragraph are based on data from Statistics Canada: *Statistics Canada*. No date. *Table 379-0031 Gross Domestic Product (GDP) at basic prices, by North American Industry Classification System (NAICS), Monthly* (table). CANSIM (database). Last updated March 2, 2018. http://www5.statcan.gc.ca/cansim/a46?lang=eng&childId=3790031&CORId=3764&viewId=1. (accessed March 3, 2018).

41 Only electric respondents were asked to break their program expenditures down by the provided program typology. CEE will continue to work with members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

then aggregates these data in order to report figures for customer class comparisons.

Canadian electric DSM expenditures totaled $572 million USD ($757 million CAD) in 2016, as shown in FIgure 13[42] below.

Figure 13 Canadian Electric DSM Expenditures 2012–2016



The $757 million CAD spent on electric DSM programs in Canada in 2016 represent a five percent increase from 2015 expenditures, a three percent increase when adjusting for inflation. Most notably in 2016, a survey response was received from a large program administrator for the first time since 2014, which resulted in a reduction in the expenditures categorized as "not broken out" as their 2014 response had been carried through in that category the previous two survey years. When "not broken out" expenditures are omitted, significant changes relative to 2015 include a 11 percent increase in the share of expenditures classified as residential, an eight percent decrease in the share of demand response, and four percent decrease in cross-sector. In 2011, CEE added the "not broken out" class to capture any expenditures program administrators could not allocate to individual customer classes,[43] which in some cases includes overall portfolio activities such as EM&V or administration and marketing.

Expenditures for 2012, 2014, and 2015 allocated to the "not broken out" category was high due to at least one large program administrator not responding in those survey years. In these cases, CEE carried through the

42 Figure 13 combines the 2016 customer classes of commercial, industrial, and C&I into the "commercial and industrial" category. Where possible, these categories are separated out in Figure 14.

43 See Section 2.4 above for more detail about the collection and differentiation of budgets, expenditures, and savings in the 2017 survey.

previous years' total expenditures as to develop a "straight line" estimate instead of letting their expenditures drop to zero. The prior expenditures for such program administrators were carried into the respective survey year's data as an estimate in the "not broken out" category.

Figure 14 below depicts 2016 Canadian electric DSM expenditures on a more granular level, broken out by customer class and excluding the "not broken out" category. Breaking from the trend seen in the past two survey years, this view of 2016 expenditures illustrates that commercial programs constitute the largest spending class in Canada in 2016, rather than demand response, with residential programs also representing a higher proportion of total Canadian electric DSM spending. However, if commercial and industrial expenditures were considered as a part of the broader "commercial and industrial" category, which includes spend not easily separated into either bucket, that category would account for 50 percent of total Canadian electric DSM spending, consistent with the results of last year's survey.

The changes in this year's expenditure breakdown is largely attributable to a response received from a large program administrator that had not responded in the previous two years. This response enabled increased granularity regarding energy efficiency expenditures, but also highlighted the implications of demand response program categorization. While outside of the current scope of this report, detail provided by respondents this year suggest that demand response programs are increasingly being bid into wholesale capacity markets, which may impact how these programs are managed and funded within an organization. CEE is taking increased care to monitor such developments to ensure that demand response programs administered by these organizations are appropriately accounted for; please see Section 3.6.3 for more information about how this was addressed in this year's analysis

Figure 14 2016 Canadian Electric DSM Expenditures by Customer Class

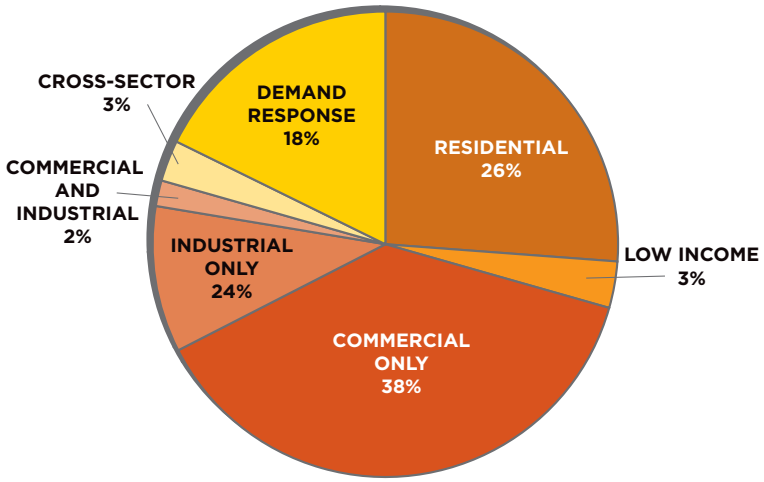
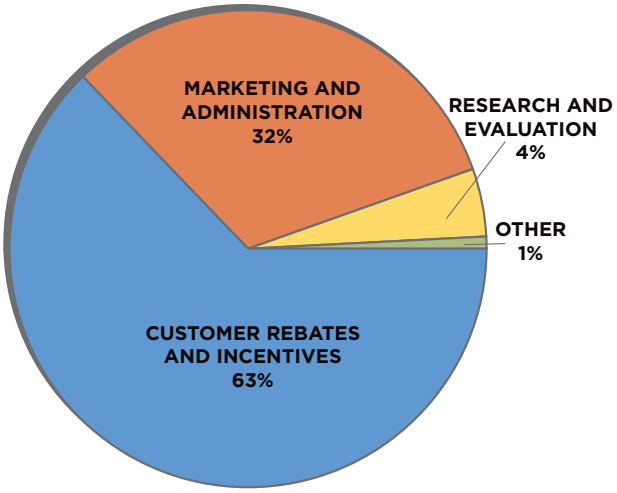


Figure 15 presents the classification of 2016 electric energy efficiency expenditures in Canada by cost category. Customer rebates and incentives represented just over half (63 percent) of 2016 expenditures, followed by marketing and administration (32 percent) and research and evaluation (four percent). The "other" category, (1 percent) which contains all funds that could not be separated into the previous three categories, is significantly reduced from 2015 due to an additional survey response from a large program administrator.

This response also drove the significant increases in the "customer rebates and incentives" and "marketing and administration" categories (up 17 and four percent respectively). The breakdown represented this year is in line with projections made in last year's report, which estimated the impact this program administrator's response would have on the breakdown of expenditures by category.

Figure 15 2016 Canadian Electric Energy Efficiency Expenditures by Category



Considering only those program administrators who responded to the survey in both 2016 and 2017, Canadian program administrators spent 89 percent of the ratepayer funds budgeted for electric DSM in 2016. This percentage is down from 98 percent in 2015, though approximately in line with levels seen in 2013 and 2012 (81 and 96 percent respectively); 2014 had a significantly lower percentage at 65 percent.

Although not depicted in Figure 15 above, in 2017 Canadian program administrators budgeted over $637 million (over $851 million CAD) for electric DSM programs. One hundred percent of this funding came exclusively from ratepayers, and the total represents a decrease of two percent as compared to 2016 budgets when adjusted for inflation.

3.6.2 Canadian Program Level Electric DSM Expenditures

Since 2013, CEE has collected program administrator information in more granular categories for each electric customer class in order to begin to better understand what types of electric programs, and possibly what products and systems, are most common in the industry. CEE has incorporated questions into the electric survey that ask respondents to report budgets, expenditures, and impacts data at the program level if possible.[44] (Please refer to Section 2.4 for more details on program categories.) These data, aggregated to customer class, indicate a breakdown similar to that in Figure 14, as all Canadian electric program administrators were able to provide a program level breakdown in

44 CEE incorporated program level questions for the electric survey only. CEE will continue to work with our members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

this year's survey. Therefore, we conclude that the program level data we obtained in 2017 are representative of overall Canadian electric energy efficiency expenditure trends.

Figure 16 lists the most common energy efficiency program types in terms of expenditures, excluding program funding categorized as "other." The programs listed represent approximately 24 percent of the program level energy efficiency expenditures reported by respondents. Demand response program level expenditures are not listed in this report but are discussed in general in Appendix C.

Figure 16 Most Common Canadian Electric Energy Efficiency Program Types by 2016 Expenditures

CUSTOMER CLASS	PROGRAM TYPE	2016 EXPENDITURES (USD)	2016 EXPENDITURES (CAD)
INDUSTRIAL	INDUSTRIAL OR AGRICULTURAL PROCESSES	$38,173,547	$50,551,585
COMMERCIAL	PRESCRIPTIVE LIGHTING	$22,207,779	$29,408,806
COMMERCIAL	CUSTOM RETROCOMMISIONING	$19,669,056	$26,046,884
LOW INCOME	LOW INCOME	$17,918,839	$23,729,148
RESIDENTIAL	CONSUMER PRODUCT REBATE—LIGHTING	$13,041,392	$17,720,154

While not listed in Figure 16, two "other" categories, "Commercial–Other" and "Residential–Other," were the two largest program categories of 2016 expenditures, jointly accounting for 54 percent of total program level expenditures. For a full disclosure of the Canadian electric energy efficiency program expenditures provided by survey respondents, please refer to Appendix B.

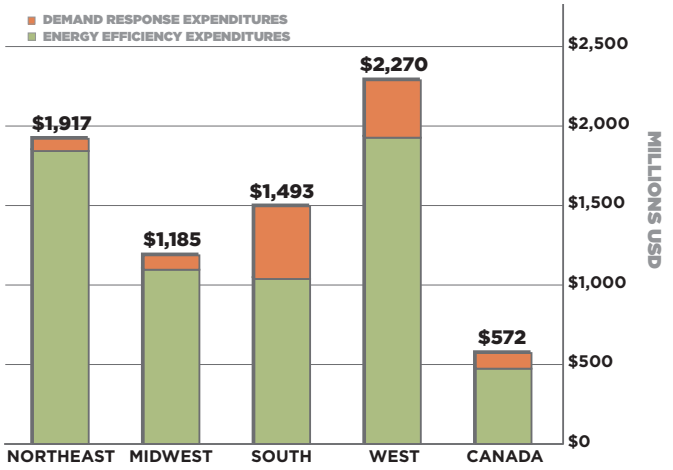
3.6.3 Canadian Electric Demand Response

The Canadian electric program administrators that responded to this survey spent over $98 million, or $130 million CAD, on their demand response programs in 2016, representing a fourteen percent increase in CAD expenditures over 2015, twelve percent when adjusting for inflation.[45] Demand response accounted for 18 percent of total Canadian electric DSM expenditures

45 This year, a response from a large Canadian program administrator suggested an ongoing recategorization of demand response programs at their organization, increasingly orienting to wholesale capacity markets. So as not to show an artificial trend while CEE investigates this situation more comprehensively, their demand response expenditures were carried through from 2014, 2015, and 2016. Should CEE determine a more accurate assessment of this or past year's data, a supplementary release may be issued refining the reported information.

(see Figure 14), 17 percent when including expenditures that were not broken out into a specific category, as are included in Figure 17.

Figure 17 US and Canadian Electric DSM Expenditures by Region, 2016



The percentage of electric expenditures devoted to demand response programs in Canada is most similar to the percentage devoted to demand response in the Midwestern United States. It is higher, in absolute terms, than the amount program administrators in the both the Northeastern and Midwestern United States spent on demand response in 2016. Similar to the 2016 report, Canadian demand response expenditures could not be broken out by program type in this year. See Appendix C for more information. [46]

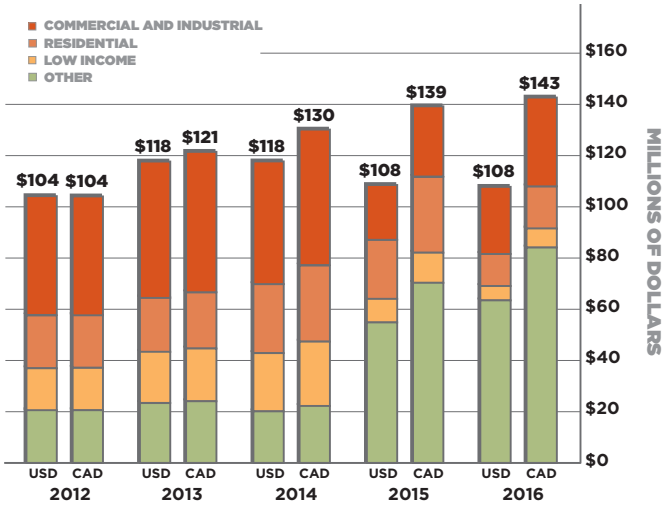
3.6.4 Canadian Natural Gas Trends

In 2016, Canadian natural gas program expenditures (in CAD) increased by three percent compared to 2015 expenditures (one percent when adjusted for inflation). Figure 18 indicates that Canadian program administrators reported 2016 expenditures of just under $108 million USD, or $143 million CAD. As evidenced by the 31 percent increase in DSM expenditures since 2012, Canadian natural gas efficiency programs continue to grow. Notably, there was a considerable increase in "other" expenditures in 2015, which continued in 2016. This increase is driven by expenditure that was assigned to the "other" category carried through to this year's analysis for two large gas program administrators that responded in 2014, but not in 2015 or 2016. In addition, an increased amount of expenditures from responding organizations were not disaggregated this year, further increasing the share of "other" expenditures. While these program administrators are included in Figure 18 to prevent the

46 In 2013, CEE modified the demand response program categories to align with those used by FERC. (See Section 2.4 for more information.)

expenditure totals from dropping arbitrarily, they are removed from the spending breakdowns shown in Figure 19 and Figure 20.

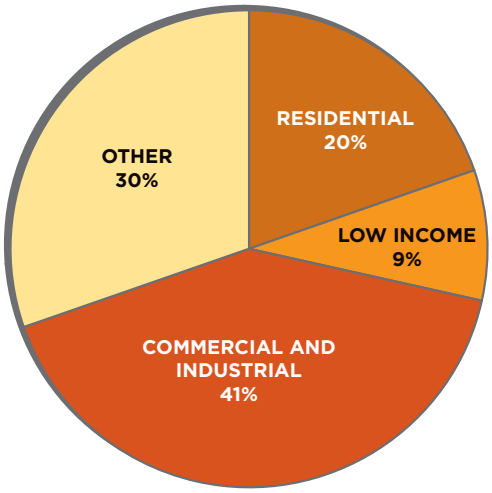
Figure 18 Canadian Natural Gas Expenditures 2012-2016



For ease of comparison between years, note that for 2013 onwards FIgure 18 combines the commercial and industrial sectors into one "commercial and industrial" customer class and the residential and multifamily sectors into one "residential" customer class, as these categories weren't broken out prior to 2013.

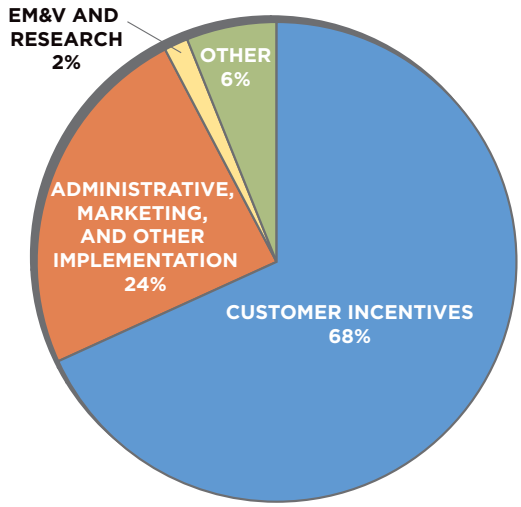
Figure 19 shows that commercial and industrial programs accounted for the largest share of Canadian natural gas efficiency program expenditures in 2015 (41 percent, up 11 percent from 2015), followed by cross-sector (30 percent, up four percent), and residential programs (29 percent, up nine percent). The share of expenditures reported as low income remains stable at 13 percent, while no multifamily expenditures were reported in 2017, a category that accounted for two percent of spending in 2015. Analysis by CEE staff suggests that the omission of the two large program administrators noted earlier reduces the share for commercial and industrial, as both have historically reported programs in that area. For ease of comparison with previous years' reports and with a concurrent report by AGA, we did not break commercial and industrial into separate classes in Figure 18 and Figure 19, but multifamily expenditures are separated from residential expenditures in Figure 19.

Figure 19 2016 Canadian Natural Gas Expenditures by Customer Class



In Figure 20 Canadian gas expenditure data are broken out into slightly different cost categories than those used in the electric data sections of this report.[47]

Figure 20 2016 Canadian Natural Gas Expenditures by Category



The category breakdown of Canadian natural gas expenditures remained similar from 2015 to 2016, with customer incentives representing roughly two-thirds of expenditures in 2016 (68 percent, up six percent from 2015). There was a moderate increase in "other" category spending (six percent, up

47 The electric and gas surveys request this information in ways that are similar, though not identical.

from four percent in 2015), though a lower proportion of spending allocated towards administrative, marketing, and other implementation (24 percent, down from 33 percent, is similar to 2014, which reported 26 percent). Research, evaluation, measurement and verification expenditures accounted for the remaining one percent of spending, while the "other" category contains all funds program administrators could not separate into the more specific categories.

Canadian natural gas program administrators budgeted more than $121 million, approximately $162 million CAD, for programs in 2017, which is nearly identical to 2016 budgets in nominal dollars but represents a three percent decrease when adjusted for inflation. Considering only those program administrators who responded to the survey in both 2016 and 2017, programs spent 93 percent of the funds that were budgeted for natural gas programs in 2016.

4 Evaluation, Measurement and Verification

CEE, along with AGA, asked survey respondents to report spending on research and EM&V in 2016. Respondents to the electric survey were asked to provide the percentage of their total 2016 energy efficiency expenditures allocated to EM&V, whereas respondents to the gas survey were asked to provide the dollar amount.[48] Figure 21 and Figure 22 present the 2016 EM&V expenditures for electric and gas energy efficiency programs in the United States and Canada.[49]

48 As in the past two years, electric EM&V expenditures in this report exclude demand response.

49 Please note, however, that the total electric expenditures in these figures only include data from program administrators who provided expenditure breakouts by category, so they are smaller than the expenditure totals presented earlier in this report.

Figure 21 US and Canadian Electric EM&V Expenditures 2016

COUNTRY	2016 EM&V EXPENDITURES (MILLIONS USD)	TOTAL 2016 ENERGY EFFICIENCY EXPENDITURES (MILLIONS USD)	EM&V % OF TOTAL EXPENDITURES
UNITED STATES	147	5,046	3%
CANADA	21	461	5%
TOTAL	168	5,507	3%

Note: This table includes estimates of EM&V expenditures for electric EE programs that were derived by multiplying total reported expenditures (from all sources) by an EM&V percentage reported by respondents. Total 2016 expenditures only include data from those respondents who provided a percentage breakout of expenditures by category and are therefore smaller than total EE expenditures listed earlier in the report.

Figure 22 US and Canadian Natural Gas EM&V Expenditures 2016

COUNTRY	2016 EM&V EXPENDITURES (MILLIONS USD)	TOTAL 2016 ENERGY EFFICIENCY EXPENDITURES (MILLIONS USD)	EM&V % OF TOTAL EXPENDITURES
UNITED STATES	27	1,300	2%
CANADA	1	49	2%
TOTAL	28	1,349	2%

Not all respondents allocate funding for evaluation purposes on an annual basis, and some respondents simply did not respond to this portion of the survey. Among those program administrators that broke out their energy efficiency expenditures by category, 75 percent of US and Canadian electric energy efficiency program administrators and 97 percent of US and Canadian gas program administrators indicated 2016 EM&V expenditures. EM&V expenditures comprised between two and five percent of 2016 energy efficiency expenditures in the United States and Canada, which is slightly higher than the proportions of between one and three percent reported in 2015, though still consistent with findings of other past research efforts.[50]

Since programs and their evaluation procedures do not necessarily occur at the same time, CEE urges caution when comparing program expenditures to expenditures allocated for EM&V activities in any given year.

50 "Energy Efficiency Program Impact Evaluation Guide," State and Local Energy Efficiency Action Network, State & Local Energy Efficiency Action Network's Evaluation, Measurement, and Verification Working Group, last modified December, 2012, https://www4.eere.energy.gov/seeaction/system/files/documents/emv_ee_program_impact_guide_0.pdf, 7-14.

5 Estimated Program Savings and Environmental Impacts

CEE collected data on energy efficiency savings from gas and electric program administrators in 2016. In order to help respondents report their savings consistently across states and provinces, CEE used the Energy Information Administration (EIA) definitions of incremental savings. According to EIA Form EIA-861, incremental savings include all energy savings that accumulated in 2016 from new 2016 participants in existing energy efficiency programs and from all participants in new 2016 programs.

CEE collected two different categories of savings values in the survey: net incremental savings and gross incremental savings.[51,52] In keeping with previous reports, this report focuses on gross incremental savings. We emphasize gross incremental savings because they are the most widely tracked savings in the industry. Gross incremental savings are also the most comparable across the United States and Canada because they contain the fewest assumptions embedded in them. In addition, gross savings provide the most useful metric for energy system planners because they include all the savings that occur, regardless of whether they were directly caused by the particular program being evaluated. On the other hand, evaluators and regulators often use net savings to measure against savings goals or to plan subsequent programs because they include only those savings that resulted directly from the program under evaluation. In all tables, CEE intended to only aggregate gross savings figures, but because program administrators do not always report gross savings values in the survey, CEE uses net savings where gross savings were not available.[53]

Although CEE worked with survey respondents to ensure they reported savings data as consistently as possible, many organizations calculate and report savings according to requirements in their states or provinces, which

51 Gross savings generally include all savings claimed by a program, regardless of the reason for participation in the program.

52 Net savings exclude whatever is typically excluded in the jurisdictions of reporting organizations. This often includes, but is not limited to, free riders, savings due to government mandated codes and standards, and the "natural operations of the marketplace," such as reduced use because of higher prices and fluctuations in weather or business cycles. Also depending on the jurisdiction, net savings sometimes incorporate additional savings resulting from spillover and market effects, which may outweigh the factors noted above and result in values that are greater than gross savings.

53 CEE worked closely with our collaborator AGA to collect savings information from survey participants. This includes collection of "annual" savings, which are incremental savings plus savings in the current year from measures that were implemented in previous years but are expected to still achieve savings. In some cases, AGA has elected to emphasize different savings data collected jointly through this effort than what CEE has chosen to emphasize. For more information on what AGA has published specifically and why, please refer to the reports that are publicly available on their website.

may not align exactly with EIA definitions. Not all organizations adjust their estimates to reflect EIA definitions. Finally, due to the timing of the request and differing evaluation cycles across organizations and jurisdictions, savings were often reported prior to evaluation and are subject to change.

5.1 Ratepayer Funded Electric Energy Efficiency Program Savings

Ratepayer funded energy efficiency programs save energy and reduce the amount of greenhouse gases emitted in the United States and Canada. As such, energy efficiency is well positioned as a cost-effective tool for meeting carbon dioxide reduction targets at both the state and national level. Reporting electric efficiency programs in the United States and Canada estimated incremental electricity savings of approximately 30,166 GWh in 2016 (see Figure 23). This is equivalent to nearly 23.1 million metric tons of avoided CO_2 emissions.[54] CEE member programs accounted for 77 percent of these estimated savings.

As noted in Section 2.2 above, this report focused only on ratepayer funded programs in previous years. Since 2013, CEE and our collaborators have collected information on electric programs derived from all funding sources in order to provide a more comprehensive picture of the DSM industry. Figure 23 and Figure 25 show ratepayer funded electric energy efficiency savings by sector and totals for both ratepayer funded programs and for programs that received funding from other sources.

Figure 23 US and Canadian Gross Incremental Electric Energy Efficiency Savings, 2016 (GWh): Ratepayer and All Sources Totals*

	RESIDENTIAL	LOW INCOME	C&I	OTHER	NO BREAKOUT	RATEPAYER TOTAL	ALL SOURCES TOTAL
UNITED STATES**							
NORTHEAST	2,227	110	2,806	7	513	4,426	5,763
MIDWEST	2,758	59	3,656	244	257	6,977	6,977
SOUTH	2,137	126	2,743	27	568	5,729	5,748
WEST	2,275	60	3,451	1,269	1,563	8,655	8,655
US SUBTOTAL	9,397	354	12,656	1,547	2,902	25,788	27,144
CANADA***	940	25	1,683	307	68	3,023	3,023
BINATIONAL TOTAL	10,337	379	14,339	1,853	2,970	28,810	30,166

* Based on estimated total of all energy savings that accumulated from new participants in existing programs and all participants in new programs in 2016.

54 Calculated using the EPA Greenhouse Gas Equivalencies Calculator, epa.gov/energy/greenhouse-gas-equivalencies-calculator. March 2018.

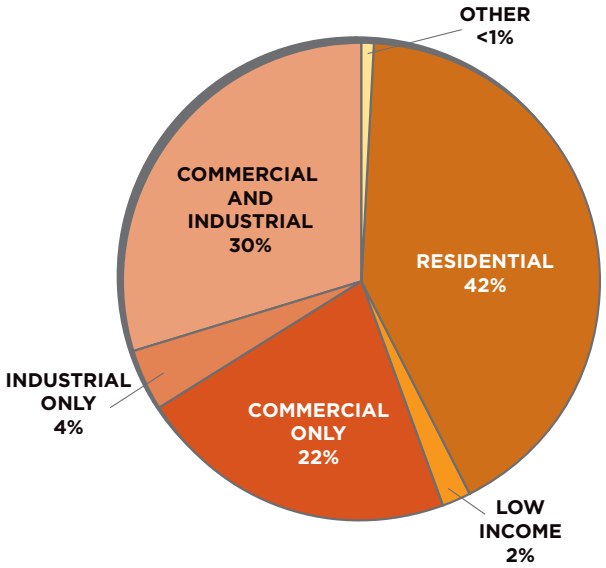
** Ninety-nine (99) percent of electric survey respondents in the United States that reported energy efficiency programs reported a value for incremental energy savings. Of those that reported a value for incremental energy savings, eighty-nine (89) percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

*** One hundred percent of electric survey respondents in Canada that reported EE programs reported a value for incremental energy savings. Of those that reported a value for incremental energy savings, 60 percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

Figure 24 shows that across the United States and Canada, ratepayer funded commercial and industrial electric programs together accounted for over half of the total energy savings (56 percent), followed by residential (42 percent), and low income (two percent). This breakdown is very similar to that of US and Canadian ratepayer electric energy efficiency expenditures, with the exception that the low income customer class makes up a smaller percentage of savings (two percent) than of expenditures (six percent) and that the residential customer class makes up a larger percentage of savings (42 percent) than of expenditures (34 percent). These findings are also consistent with the last two years of survey results, reinforcing these relative relationships of savings and expenditures by sector. Low income programs are generally mandated for the public benefit, and while they may not result in high savings, they may result in significant benefits for program administrators in the form of reduced arrearages and for customers in the form of lower energy bills and higher disposable income. This likely explains the difference in the proportions of expenditures and savings represented by low income programs.

As noted in Section 2.4, respondents to the survey may interpret the categories differently, and not all respondents broke their information out by customer class. Therefore, Figure 24 represents only those savings reported at the customer class level and does not include the savings reported as “No Breakout” in Figure 23.

Figure 24 2016 US and Canadian Gross Incremental Electric Energy Efficiency Savings by Customer Class



Based on the gross incremental savings figure for electric efficiency programs provided in Figure 23, in 2016 the value of ratepayer funded electric energy efficiency savings across the United States and Canada was over $3.0 billion.[55,56]

Beginning in 2013, CEE asked respondents to provide estimates of capacity savings from their energy efficiency programs. Capacity savings estimates are depicted in Figure 25.

55 US electric retail values were calculated based on the average retail price of electricity to ultimate customer by end use sector across the United States in 2016 using data from the Electric Power Monthly December 2017 issue, which contains YTD 2016 data. Average electric rates used: $ 0.1255 per kWh (residential), $0.1043 (commercial), and $0.0676 (industrial). The residential retail rate was used for low income program savings. The rate for combined C&I programs was determined by taking the average of the commercial and industrial retail rates. The rate for "other" programs was determined by taking the average of the residential, commercial, and industrial retail rates. "Electric Power Monthly: Table 5.3. Average Price of Electricity to Ultimate Customers," Energy Information Administration, last modified February 2018, accessed March 2018, eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_03.

56 Canadian electric retail values were calculated based on the average rate per kWh across Canada in 2016 using data from an analysis maintained by Manitoba Hydro titled "Utility Rate Comparisons." Average electric rates used: $ 0.1177 CAD per kWh (residential), $ 0.1172 CAD per kWh (commercial) and $ 0.0783 per kWh (industrial). The residential retail rate was used for low income program savings. The rate for "other" programs was determined by taking the average of the residential and the commercial and industrial retail rates. The residential figure is an average of the rates for 12 major cities in Canada, and commercial and industrial figures an average of those for the associate utilities of those cities and may not reflect the average electricity price for Canada as a whole. "Manitoba Hydro: 2017–18 and 2018–19 General Rate Application," Manitoba Hydro, accessed March 2018, https://www.hydro.mb.ca/regulatory_affairs/electric/gra_2017_2019/index.shtml.

Figure 25 2016 US and Canadian Electric EE Gross Incremental* Capacity Savings (MW)

	RESIDENTIAL	LOW INCOME	C&I	OTHER	NO BREAKOUT	RATEPAYER TOTAL	ALL SOURCES TOTAL
UNITED STATES**							
NORTHEAST	317	15	491	0	21	641	843
MIDWEST	613	11	609	54	31	1,319	1,319
SOUTH	574	51	697	12	98	1,419	1,432
WEST	400	11	547	211	371	1,540	1,540
US SUBTOTAL	1,903	89	2,344	277	521	4,919	5,134
CANADA***	212	8	401	104	18	743	743
BINATIONAL TOTAL	2,115	97	2,744	381	539	5,662	5,877

* Based on estimated total of all capacity savings that accumulated from new participants in existing programs and all participants in new programs in 2016.

** Eighty-five (85) percent of electric survey respondents in the United States that reported energy efficiency programs reported a value for incremental capacity savings. Of those that reported a value for incremental energy savings, 76 percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

*** One hundred percent of respondents in Canada that reported energy efficiency programs reported a value for incremental capacity savings. Of those that reported a value for incremental savings, 60 percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

Unlike energy savings, which are reported in kilo-, mega-, or gigawatt hours and measure the amount of energy saved over time, capacity savings are measured in kilo-, mega-, or gigawatts and represent reductions in demand forecast to occur at a particular time, generally during hours of peak demand. The capacity savings that result from energy efficiency programs can be very valuable, particularly in areas with constrained transmission capacity or high summer or winter peaks.

5.1.1 Electric Demand Response Program Savings

Beginning in 2015, CEE asked demand response program administrators to report the number of events called for each of their demand response programs, the average savings per event, and each program target (summer peak, winter peak, another peak, or "non-peak," which refers to a target other than a peak). Survey respondents could designate their programs as having more than one target.[57] Respondents only reported eleven "other peak"

57 Note that program target is separate from program type, for example, direct load control. Savings by program type are not analyzed here.

programs and eight "non-peak" programs, and the majority of programs in each of these categories were identified as having multiple targets. Thus, the savings for "other peak" and "non-peak" programs reported below are likely overestimates at the expense of summer and winter peak programs. CEE may consider soliciting more information on "other peak" and "non-peak" programs in the future in order to better estimate the associated savings.

We report both "total" MW savings and average MW savings per event below, grouped by region and program target. Total MW savings, calculated as the average savings per event multiplied by the number of events, are abstract in that they denote the total capacity reduced over the course of an entire program year. As in 2016, in 2017 CEE did not ask respondents for their peak duration and therefore could not calculate total MWh savings from the total savings below. This report presents total MW savings to provide a general idea of capacity reductions by programs, but we believe average MW reductions per event provide a better indicator of program activity.

Figure 26 US and Canadian Electric Demand Response Total MW Savings by Program Target and Region

	SUMMER	WINTER	OTHER PEAK	NO PEAK	ALL
NORTHEAST	648	-	63	-	711
MIDWEST	4,487	-	380	-	4,867
SOUTH	16,027	5,788	57	1,922	23,795
WEST	7,688	2,128	1,143	1,083	12,041
CANADA	-	-	-	54	54
TOTAL	28,850	7,916	1,643	3,059	41,468

As shown in Figure 26, US and Canadian demand response programs reduced capacity by 41,468 MW in 2016.[58] Fifty-seven percent of savings came from programs in the South, 29 percent from programs in the West, 12 percent from programs in Canada, and two percent from programs in the Northeast. Please note that CEE asks respondents to include programs run within their service territories and to exclude any programs run solely by or within the wholesale markets.[59] Four respondents in the Northeast reported demand response

58 For reference, FERC reported that in 2014 the potential peak reduction from all retail demand response programs in the United States was 31,191 MW. "Demand Response and Advanced Metering Staff Report," Federal Energy Regulatory Commission, ferc.gov/legal/staff-reports/2016/DR-AM-Report2016.pdf, 14.

59 In 2017 CEE received a partial response from this program administrator, suggesting that their demand response programs may be increasingly run within the wholesale capacity markets. While CEE investigates this development and the potential of a broader industry trend, their previous demand response spending was carried through in this analysis, consistent with the previous three years. That said, in line with past reporting practices, should it be found that this was an inaccurate

savings, three more than in 2016, while only one respondent in Canada reported demand response savings this year. Seventy percent of savings were achieved during summer peaks, 15 percent during winter peaks, seven percent in relation to programs that did not target a peak, and four percent in relation to programs focused on "other" peaks.

Figure 27 US and Canadian Electric Demand Response Average MW Savings by Region and Program Target

	SUMMER	WINTER	OTHER PEAK	NO PEAK	MW SUBTOTALS
NORTHEAST	11	-	32	-	11
MIDWEST	59	-	190	-	62
SOUTH	62	50	10	22	51
WEST	7	8	48	57	7
CANADA	-	-	-	18	18
TOTALS	19	15	46	28	20

FIgure 27 presents average MW savings by region and target. Demand response programs in the United States and Canada saved on average 20 MW per event in 2016.[60] In the United States, the Midwest saved the most on average per event, 62 MW. Reported "other peak" programs saved the most on average per event, 46 MW, followed by nonpeak programs, 28 MW, summer, 19 MW, and winter, 15 MW.

5.2 Ratepayer Funded Natural Gas Program Savings

Figure 28 indicates that natural gas efficiency programs in the United States and Canada resulted in estimated gross incremental savings of more than 521 million therms of gas in 2016. This is equivalent to approximately 2.7 million metric tons of avoided CO_2 emissions.[61] CEE member programs accounted for 80 percent of the total energy savings estimate.

representation of 2016 demand response expenditure at this organization, the information will be retroactively adjusted in subsequent releases.

60 To get a sense of magnitude for average US and Canadian demand response capacity savings, 20 MW represents roughly a sixth of the peak capacity of a natural gas combined cycle generating unit in the United States, according to 2015 EIA Form 860, Schedule 3 data. In addition, using 2016 EIA Form 860, Schedule 3 data, the "total" demand response savings of 41,468 MW is roughly equivalent to the combined net summertime capacity of the 33 largest power plants in the United States, or at least the ones that responded to the EIA data request. Data accessed at "Form EIA-860 detailed data," Energy Information Administration, accessed March 2018, eia.gov/electricity/data/eia860/.

61 Calculated using the EPA Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator. March 2018.

Figure 28 2016 US and Canadian Incremental Natural Gas Savings (MDth)

	RESIDENTIAL	LOW INCOME	MULTIFAMILY	C&I	OTHER	NO BREAKOUT	RATEPAYER TOTAL
UNITED STATES**							
NORTHEAST	2,938	676	634	3,341	53	0	7,642
MIDWEST	7,352	653	647	10,572	647	0	19,871
SOUTH	814	43	2	1,799	0	0	2,657
WEST	2,098	303	212	2,705	5,432	0	10,750
US SUBTOTAL	13,202	1,675	1,495	18,417	6,131	0	40,921
CANADA***	115	36	0	1,947	9,114	0	11,239
BINATIONAL TOTAL	13,317	1,712	1,495	20,391	15,245	0	52,160

* Based on estimated total of all energy savings that accumulated from new participants in existing programs and all participants in new programs in 2016.

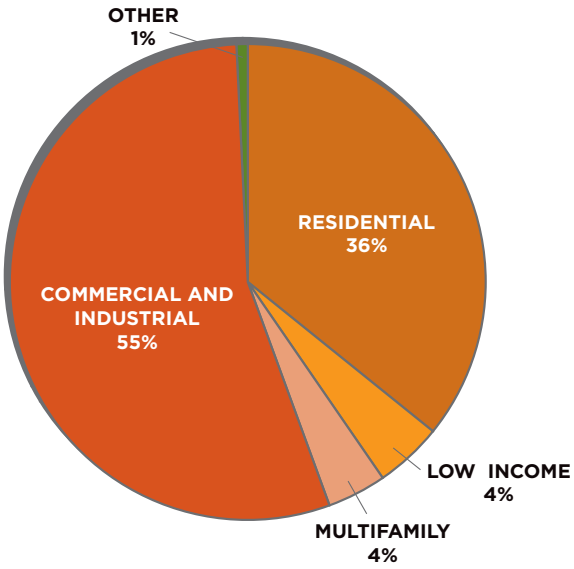
** Eighty-five (85) percent of all gas respondents in the United States that reported gas programs reported a value for incremental savings. Of those that reported a value for incremental savings, ninety-three percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

** One hundred percent of all gas respondents in Canada that reported gas programs reported a value for incremental savings. Of those that reported a value for incremental savings, 80 percent reported gross incremental savings.

Figure 29 depicts gross incremental savings for US and Canadian natural gas programs broken out by customer class. Commercial and industrial programs accounted for the majority of energy savings (39 percent), followed by "other" programs (29 percent), and residential programs (26 percent). Low income programs and multifamily programs both represented three percent of savings. The higher proportion of "other" savings in 2016 is driven in large part by two large Canadian program administrators carried through in 2016, and a relatively higher allocation of "other" spending among respondents this year. This breakdown is somewhat different from that of US and Canadian gas energy efficiency expenditures, in which residential programs accounted for 39 percent of expenditures, commercial and industrial programs accounted for 22 percent, and low income programs accounted for 21 percent. These findings are similar to those from last year's survey. This result may indicate high savings per dollar spent in the C&I sector, but it may also reflect a difference in reported savings type—gross or net—between program administrators with high residential and high C&I expenditures.[62]

62 See the opening paragraphs of Section 5 for more information on the savings accounting scheme used in this report.

Figure 29 2016 US and Canadian Gross Incremental Natural Gas Savings by Customer Class



Based on the natural gas gross incremental savings provided in Figure 28 and the savings breakout in Figure 29, in 2016 the value of natural gas energy efficiency savings across the United States and Canada totaled approximately $372 million.[63]

63 Natural gas retail values for the United States and Canada were calculated based on the average retail price per thousand cubic feet across the United States in 2016 using data from the Energy Information Administration. Average natural gas prices used: $10.05 per Mcf (residential), $7.91 per Mcf (commercial), and $3.93 per Mcf (industrial). The residential retail rate was used for low income and multifamily program savings. The rate for combined C&I programs was determined by taking the average of the commercial and industrial retail rates. The rate for "other" programs was calculated by taking the average of the residential, commercial, and industrial retail rates. "Natural Gas Prices," Energy Information Administration, last modified February 28, 2018, accessed March 3, 2018, eia.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm.

Appendix A Electric Energy Efficiency Program Categories

Respondents who could provide data for individual programs were asked to select a customer class and then a program type for each program they identified. If it was not possible to provide data on the program level, respondents were asked to provide rough percentage breakdowns of their budgets, expenditures, and savings into customer classes and then to provide further percentage breakdowns by common program types (again, if possible). This appendix provides the title and definition for each program type, grouped by customer class. CEE slightly modified some program categories in 2014 based on feedback from respondents and discussions with Lawrence Berkeley National Laboratory; similar modifications may occur in future years for the purposes of the CEE research effort.

Residential Programs

Appliance recycling Programs designed to remove less efficient appliances, typically refrigerators and freezers, from households.

Behavior, online audit, feedback Residential programs designed around directly influencing household habits and decision making on energy consumption through quantitative or graphical feedback on consumption, sometimes accompanied by tips on saving energy. These programs include behavioral feedback programs in which energy use reports compare a consumer's household energy consumption with those of similar consumers, online audits that are completed by the consumer, and in-home displays that help consumers assess their use in near real time. This program category does not include on-site energy assessments or audits.

Consumer product rebate for appliances Programs that incentivize the sale, purchase, and installation of appliances such as refrigerators, dishwashers, clothes washers, and dryers, that are more efficient than current standards. Appliance recycling and the sale, purchase, and installation of HVAC equipment, water heaters, and consumer electronics are accounted for separately.

Consumer product rebate for electronics Programs that encourage the availability and purchase or lease of more efficient personal and household electronic devices, including but not limited to televisions, set-top boxes, game consoles, advanced power strips, cordless telephones, PCs and peripherals specifically for home use along with chargers for phones, smart phones, and

tablets. A comprehensive efficiency program to decrease the electricity use of consumer electronics products includes two foci: product purchase and product use. Yet not every consumer electronics program seeks to be comprehensive. Some programs embark on ambitious promotions of multiple electronics products, employing upstream, midstream, and downstream strategies with an aggressive marketing and education component. At the other end of the continuum, a program administrator may choose to focus exclusively on consumer education.

Consumer product rebate for lighting Programs aimed specifically at encouraging the sale, purchase, and installation of more efficient lighting in the home. These programs range widely from point-of-sale rebates to CFL mailings or giveaways. Measures tend to be CFLs, fluorescent fixtures, LED lamps, LED fixtures, LED holiday lights, and lighting controls, including occupancy monitors and switches.

Financing Programs designed to provide or facilitate loans, credit enhancements, or interest rate reductions and buy downs. As with other programs, utility costs are included, such as the costs of any inducements for lenders (for example, loan loss reserves, interest rate buy downs, et cetera). Where participant costs are available for collection, these ideally include the total customer share, that is both principal (meaning the participant payment to purchase and install measures) and interest on that debt. Most of these programs are directed towards enhancing credit or financing for residential structures.

Multifamily Multifamily programs are designed to encourage the installation of energy efficient measures in common areas, units, or both, for residential structures of more than four units. These programs may be aimed at building owners or managers, tenants, or both.

New construction Programs that provide incentives and possibly technical services to ensure new homes are built or manufactured to energy performance standards higher than applicable code, for example, ENERGY STAR® Homes. These programs include new multifamily residences and new or replacement mobile homes.

Prescriptive HVAC Programs designed to encourage the distribution, sale, purchase, and proper sizing and installation of HVAC systems that are more efficient than current standards. Programs tend to support activities that focus on central air conditioners, air source heat pumps, ground source heat pumps, and ductless systems that are more efficient than current energy performance

standards, as well as climate controls and the promotion of quality installation and quality maintenance.

Prescriptive insulation Programs designed to encourage the sale, purchase, and installation of insulation in residential structures, often through per square foot incentives for insulation of specific R-values versus an existing baseline. Programs may be point-of-sale rebates or rebates to insulation installation contractors.

Prescriptive pool pump Programs that incentivize the installation of higher efficiency or variable speed pumps and controls, such as timers, for swimming pools.

Prescriptive water heater Programs designed to encourage the distribution, sale, purchase, and installation of electric or gas water heating systems that are more efficient than current standards, including high efficiency water storage tank and tankless systems.

Prescriptive windows Programs designed to encourage the sale, purchase, and installation of efficient windows in residential structures.

Prescriptive other Residential programs that provide or incentivize a set of preapproved measures not included in, or distinguishable from, the other residential program categories, such as whole home direct install, HVAC, or lighting. For example, if a residential program features rebates for a large set of mixed, preapproved offerings, such as insulation, HVAC, appliances, and lighting, yet the relative contribution of each measure to program savings is unclear or no single measure accounts for a large majority of the savings, then the program should be classified simply as a "prescriptive other" program.

Whole home audits Residential audit programs provide a comprehensive, stand-alone assessment of a home's energy consumption and identification of opportunities to save energy. The scope of the audit includes the whole home, although the thoroughness and completeness of the audit may vary widely, from a modest examination and development of a simple engineering model of the physical structure to a highly detailed inspection of all spaces, testing for air leakage or exchange rates, testing for HVAC duct leakage, and highly resolved modeling of the physical structure with benchmarking to customer utility bills.

Whole home direct install Direct install programs provide a set of preapproved measures that may be installed at the time of a visit to the customer premises or provided as a kit to the consumer, usually at modest or no cost to the consumer and sometimes accompanied by a rebate. Typical

measures include CFLs, low flow showerheads, faucet aerators, water heater wrap, and weather stripping. Such programs also may include a basic walk-through energy assessment or audit, but the savings are principally derived from the installation of the provided measures. Education programs that supply kits by sending them home with school children are not included in this program category as they are classified as education programs.

Whole home retrofit Whole home energy upgrade or retrofit programs combine a comprehensive energy assessment or audit that identifies energy savings opportunities with whole house improvements in air sealing, insulation, and often HVAC systems and other end uses. The HVAC improvements may range from duct sealing, to a tune-up, or a full replacement of the HVAC systems. Whole home programs are designed to address a wide variety of individual measures and building systems, including but not limited to: HVAC equipment, thermostats, furnaces, boilers, heat pumps, water heaters, fans, air sealing, insulation (of the attic, walls, or basement), windows, doors, skylights, lighting, and appliances. As a result, whole home programs generally involve one or more rebates for multiple measures. Whole home programs generally come in two types, comprehensive programs that are broad in scope, and less comprehensive prescriptive programs, sometimes referred to as "bundled efficiency" programs. This category addresses all of the former and most of the latter, but it excludes direct install programs that are accounted for separately.

Other Programs designed to encourage investment in energy efficiency activities in residences but are so highly aggregated and undifferentiated (such as existing homes programs that include retrofits, appliances, equipment, et cetera) that they cannot be sorted into the residential program categories that are detailed above.

Low Income

Low income programs are efficiency programs aimed at lower income households, based upon some types of income testing or eligibility. These programs most often take the form of a single family weatherization, but a variety of other program types are also included in this program category, for example, multifamily or affordable housing weatherization, or low income direct install programs.

Commercial Programs

Custom audit Programs in which an energy assessment is performed on one or more participant commercial or industrial facilities to identify sources of potential energy waste and measures to reduce that waste.

Custom retrocommissioning Programs aimed at diagnosing energy consumption in a commercial facility and optimizing its operations to minimize energy waste. Such programs may include the installation of certain measures, such as occupancy monitors and switches, but program activities tend to be characterized more by tuning, coordinating, and testing the operation of existing end uses, systems, and equipment for energy efficient operation. The construction of new commercial facilities that include energy performance commissioning should be categorized as "new construction". The de novo installation of energy management systems with accompanying sensors, monitors, and switches is regarded as a major capital investment and should be categorized under "custom other".

Custom other Programs designed around the delivery of site-specific projects typically characterized by an extensive onsite energy assessment and identification and installation of multiple measures unique to that facility. These measures may vary significantly from site to site. This category is intended to capture whole building approaches to commercial sector efficiency opportunities for a wide range of building types and markets (for example, office or retail) and a wide range of measures.

Financing Programs designed to provide or facilitate loans, credit enhancements, or interest rate reductions and buy downs. As with other programs, utility costs are included, such as the costs of any inducements for lenders (for example, loan loss reserves, interest rate buy downs, et cetera). Where participant costs are available for collection, these ideally include the total customer share, that is, both principal (meaning the participant payment to purchase and install measures) and interest on that debt. Most of these programs are directed toward enhancing credit or financing for commercial structures.

Government, nonprofit, MUSH Government, nonprofit, and MUSH (municipal, university, school, and hospital) programs cover a broad swath of program types generally aimed at public and institutional facilities and include a wide range of measures. Programs that focus on specific technologies, such as HVAC and lighting, have their own commercial program categories. Examples include incentives or technical assistance to promote energy efficiency

upgrades for elementary schools, recreation halls, and homeless shelters. Street lighting is accounted for as a separate program category.

New construction Programs that incentivize owners or builders of new commercial facilities to design and build beyond current code or to a certain certification level, such as ENERGY STAR® or LEED®.

Prescriptive grocery Grocery programs are prescriptive programs aimed at supermarkets and are usually designed around indoor and outdoor lighting and refrigerated display cases.

Prescriptive HVAC Commercial HVAC programs encourage the sale, purchase, and installation of heating, cooling, or ventilation systems at higher efficiency than current energy performance standards, across a broad range of unit sizes and configurations.

Prescriptive IT and office equipment Programs aimed at improving the efficiency of office equipment, chiefly commercially available PCs, printers, monitors, networking devices, and mainframes, not rising to the scale of a server farm or floor. Programs for data centers are included in the industrial sector, under the "custom data centers" category.

Prescriptive lighting Commercial lighting programs incentivize the installation of higher efficiency lighting and controls. Typical measures might include T8 or T5 fluorescent lamps and fixtures, CFLs and fixtures, LEDs (for lighting displays, signs, and refrigerated lighting), metal halide and ceramic lamps and fixtures, occupancy controls, daylight dimming, and timers.

Prescriptive performance contract or DSM bidding Programs that incentivize or otherwise encourage energy services companies (ESCOs) and participants to perform energy efficiency projects, usually under an energy performance contract (EPC), a standard offer, or another arrangement that involves ESCOs or customers offering a quantity of energy savings in response to a competitive solicitation process with compensation linked to achieved savings.

Prescriptive other Prescriptive programs that encourage the purchase and installation of some or all of a specified set of preapproved measures besides those covered in other measure-specific prescriptive programs, such as HVAC and lighting.

Small commercial custom Custom programs applied to small commercial facilities. See the "custom" commercial categories for additional detail.

Small commercial prescriptive Prescriptive programs applied to small commercial facilities. See the "prescriptive" commercial categories for

additional detail. Such programs may range from a walk-through audit and direct installation of a few preapproved measures to a fuller audit and a fuller package of measures. Audit only programs have their own category.

Street lighting Street lighting programs include incentives or technical support for the installation of higher efficiency street lighting and traffic lights than current baseline.

Other Programs not captured by any of the specific industrial or commercial categories but that are sufficiently detailed or distinct to not be treated as a General C&I program. For example, an energy efficiency program aimed specifically at the commercial subsector but is not clearly prescriptive or custom in nature might be classified as "other".

Industrial or Agricultural Programs

Custom audit Programs in which an energy assessment is performed on one or more participant industrial or agricultural facilities to identify sources of potential energy waste and measures to reduce that waste.

Custom data centers Data center programs are custom designed around large-scale server floors or data centers that often serve high tech, banking, or academia. Projects tend to be site specific and involve some combination of lighting, servers, networking devices, cooling chillers, and energy management systems and software. Several of these may be of experimental or proprietary design.

Custom industrial or agricultural processes Industrial programs that deliver custom designed projects that are characterized by onsite energy and process efficiency assessment and a site specific measure set focused on process related improvements that may include, for example, substantial changes in a manufacturing line. This category includes all energy efficiency program work at industrial or agricultural sites that is focused on process and not generic (such programs belong in the custom category) and not otherwise covered by the single measure prescriptive programs, such as lighting, HVAC, and water heaters.

Custom refrigerated warehouses Warehouse programs are typically aimed at large-scale refrigerated storage facilities and often target end uses such as lighting, climate controls, and refrigeration systems.

Custom other Programs designed around the delivery of site specific projects typically characterized by an extensive onsite energy assessment and identification and installation of multiple measures unique to that facility.

These measures may vary significantly from site to site. This category is intended to capture whole facility approaches to industrial or agricultural sector efficiency opportunities for a wide range of building types and markets.

Financing Programs designed to provide or facilitate loans, credit enhancements, or interest rate reductions and buy downs. As with other programs, utility costs are included, such as the costs of any inducements for lenders (for example, loan loss reserves, interest rate buy downs, et cetera). Where participant costs are available for collection, these ideally include the total customer share, that is, both principal (meaning the participant payment to purchase and install measures) and interest on that debt. Most of these programs are directed toward enhancing credit or financing for industrial or agricultural structures.

New construction Programs that incentivize owners of builders of new industrial or agricultural facilities to design and build beyond current code or to a certain certification level, such as ENERGY STAR® or LEED®.

Prescriptive agriculture Farm and orchard agricultural programs that primarily involve irrigation pumping and do not include agricultural refrigeration or processing at scale.

Prescriptive motors Motors programs usually offer a prescribed set of approved, higher efficiency motors, with industrial motors programs typically getting the largest savings from larger, high powered motors, greater than 200 horsepower.

Prescriptive other Prescriptive programs that encourage the purchase and installation of some or all of a specified set of preapproved measures besides those covered in other measure specific prescriptive programs on this list.

Self direct Industrial programs that are designed to be delivered by the participant, using funds that otherwise would have been paid as ratepayer support for all DSM programs. These programs may be referred to as “opt out” programs, among other names.

Other Programs not captured by any of the specific industrial or agricultural program categories but that are sufficiently distinct to the industrial and agricultural sector to not be treated as a C&I program, e.g. programs aimed specifically at an industrial subsector, but that are not clearly prescriptive or custom in nature.

C&I Programs

Audit Programs in which an energy assessment is performed on one or more participant facilities to identify sources of potential energy waste and measures to reduce that waste.

Custom Programs designed around the delivery of site-specific projects typically characterized by an extensive onsite energy assessment and identification and installation of multiple measures unique to that facility. These measures may vary significantly from site to site. This category is for programs that address both the commercial and industrial sectors and cannot be relegated to one sector or another for lack of information on participation or savings.

Mixed offerings Programs that cannot be classified under any of the specific commercial or industrial program categories and that span a large variety of offerings aimed at both the commercial and industrial sectors.

New construction Programs that incentivize owners or builders of new commercial or industrial facilities to design and build beyond current code or to a certain certification level, such as ENERGY STAR® or LEED®. This category should be used sparingly for those programs that cannot be identified with either the commercial or industrial sector on the basis of information available about participation or the sources of savings.

Prescriptive Prescriptive programs that encourage the purchase and installation of some or all of a specified set of preapproved industrial or commercial measures but which cannot be differentiated by sector based upon the description of the participants or the nature or source of savings.

Self direct Generally large commercial and industrial programs that are designed and delivered by the participant, using funds that otherwise would have been paid as ratepayer support for all DSM programs. This category is to be used for self direct or opt out programs that address both large commercial and industrial entities but that cannot be differentiated between these sectors because the nature and source of the savings is not available or is also too highly aggregated.

Other Programs not captured by any of the specific industrial or commercial categories and are sufficiently distinct to the industrial and commercial sectors but cannot be differentiated by individual sector.

Cross Sector

Codes and standards In codes and standards programs, the program administrator may engage in a variety of activities designed to advance the adoption, application or compliance level of building codes and end use energy performance standards. Examples might include advocacy at the state or federal level for higher standards for HVAC equipment; training of architects, engineers, builders, and developers on compliance; and training of building inspectors in ensuring the codes are met.

Market transformation Programs that encourage a reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects that is likely to last after the intervention has been withdrawn, reduced, or changed. Market transformation programs are gauged by their market effects, for example increased awareness of energy efficient technologies among customers and suppliers, reduced prices for more efficient models, increased availability of more efficient models, and ultimately, increased market share for energy efficient goods, services, and design practices. Example programs might include upstream incentives to manufacturers to make more efficient goods more commercially available and point-of-sale or installation incentives for emerging technologies that are not yet cost-effective. Workforce training and development programs are covered by a separate category. Upstream incentives for commercially available goods are sorted into the program categories for those goods, fore example, consumer electronics or HVAC.

Marketing, education, and outreach Includes most standalone marketing, education, and outreach programs, e.g. statewide marketing, outreach, and brand development. This category also covers in-school energy and water efficiency programs, including those that supply school children with kits of prescriptive measures such as CFLs and low flow showerheads for installation at home.

Multisector rebates Multisector rebate programs include those providing incentives for commercially available end use goods for multiple sectors, such as PCs, or HVAC.

Planning, evaluation, other program support These programs are separate from marketing, education, and outreach programs and include the range of activities not otherwise accounted for in program costs, but that are needed for planning and designing a portfolio of programs and for otherwise complying with regulatory requirements for DSM activities outside of program implementation. These activities generally are focused on the front and back

end of program cycles, in assessing prospective programs; designing programs and portfolios; assessing the cost-effectiveness of measures, programs, and portfolios; and arranging for, directing, or delivering reports and evaluations of the process and impacts of those programs where those costs are not captured in program costs.

Research These programs are aimed generally at helping the program administrator identify new opportunities for energy savings, for example, research on emerging technologies or conservation strategies. Research conducted on new program types or the inclusion of new, commercially available measures in an existing program are accounted for separately under cross cutting program support.

Shading and cool roofs Shading and reflective programs include programs designed to lessen heating and cooling loads through changes to the exterior of a structure, such as tree plantings to shade walls and windows, window screens, and cool roofs. These programs are not necessarily specific to a sector.

Voltage reduction transformers Programs that support investments in distribution system efficiency or enhance distribution system operations by reducing losses. The most common form of these programs involve the installation and use of conservation voltage regulation or reduction or optimization systems and practices that control distribution feeder voltage so that utilization devices operate at their peak efficiency, which is usually at a level near the lower bounds of their utilization or nameplate voltages. Other measures may include installation of higher efficiency transformers. These programs generally are not targeted to specific end users but typically involve changes made by the electricity distribution utility.

Workforce development Workforce training and development programs are a distinct category of market transformation program designed to provide the underlying skills and labor base for deployment of energy efficiency measures.

Other This category is intended to capture all programs that cannot be allocated to a specific sector, or are multisectoral, and cannot be allocated to a specific program type.

Appendix B List of US and Canadian Electric Energy Efficiency Program Category Expenditures

Figure B-1 US Electric Energy Efficiency Program Category Expenditures (in USD)

CUSTOMER CLASS	PROGRAM TYPE	2016 EXPENDITURES
RESIDENTIAL	OTHER	$597,864,587.21
COMMERCIAL AND INDUSTRIAL	MIXED OFFERINGS	$560,032,277.01
COMMERCIAL	OTHER	$394,253,071.34
LOW INCOME	LOW INCOME	$331,144,219.33
RESIDENTIAL	CONSUMER PRODUCT REBATE FOR LIGHTING	$244,220,440.56
COMMERCIAL AND INDUSTRIAL	OTHER	$220,168,464.67
COMMERCIAL AND INDUSTRIAL	CUSTOM	$214,962,376.23
COMMERCIAL AND INDUSTRIAL	PRESCRIPTIVE	$200,723,641.30
COMMERCIAL	SMALL COMMERCIALPRESCRIPTIVE	$193,282,913.86
COMMERCIAL	GOVT., NONPROFIT, MUSH	$175,101,546.26
RESIDENTIAL	WHOLE HOME RETROFIT	$127,286,878.60
COMMERCIAL	PRESCRIPTIVE OTHER	$125,669,763.38
COMMERCIAL AND INDUSTRIAL	NEW CONSTRUCTION	$98,992,619.87
RESIDENTIAL	PRESCRIPTIVE HVAC	$91,751,962.09
RESIDENTIAL	BEHAVIORAL, ONLINE AUDIT, FEEDBACK	$85,276,628.11
CROSS SECTOR	MULTISECTOR REBATES	$83,221,734.59
INDUSTRIAL	OTHER	$82,861,619.99
RESIDENTIAL	WHOLE HOME DIRECT INSTALL	$82,206,764.05
RESIDENTIAL	WHOLE HOME AUDITS	$81,447,951.68
COMMERCIAL	PRESCRIPTIVE LIGHTING	$73,462,992.07
RESIDENTIAL	CONSUMER PRODUCT REBATE APPLIANCES	$72,721,422.33
CROSS SECTOR	PLANNING, EVALUATION, OTHER PROGRAM SUPPORT	$70,980,142.28
CROSS SECTOR	OTHER	$70,263,541.59
COMMERCIAL	CUSTOM, OTHER	$58,176,862.13
INDUSTRIAL	CUSTOM, INDUSTRIAL OR AGRICULTURAL PROCESSES	$56,200,204.92
RESIDENTIAL	PRESCRIPTIVE OTHER	$54,268,352.79
CROSS SECTOR	MARKETING, EDUCATION, OUTREACH	$51,743,515.14
RESIDENTIAL	NEW CONSTRUCTION	$50,431,214.01
RESIDENTIAL	MULTIFAMILY	$43,162,328.26
COMMERCIAL	PRESCRIPTIVE HVAC	$40,569,511.79
RESIDENTIAL	APPLIANCE RECYCLING	$35,933,417.33
CROSS SECTOR	CODES AND STANDARDS	$30,113,536.01

CUSTOMER CLASS	PROGRAM TYPE	2016 EXPENDITURES
CROSS SECTOR	MARKET TRANSFORMATION	$25,926,276.69
COMMERCIAL	NEW CONSTRUCTION	$23,267,987.71
COMMERCIAL	CUSTOM AUDIT	$21,851,779.09
COMMERCIAL	SMALL COMMERCIAL CUSTOM	$14,220,102.01
COMMERCIAL AND INDUSTRIAL	AUDIT	$13,788,099.77
RESIDENTIAL	CONSUMER PRODUCT REBATE ELECTRONICS	$12,300,229.00
COMMERCIAL	CUSTOM RETROCOMMISSIONING	$10,803,852.57
INDUSTRIAL	PRESCRIPTIVE OTHER	$6,361,790.21
RESIDENTIAL	PRESCRIPTIVE INSULATION	$5,885,700.00
CROSS SECTOR	RESEARCH	$5,804,741.50
INDUSTRIAL	PRESCRIPTIVE AGRICULTURE	$3,566,727.65
INDUSTRIAL	CUSTOM AUDIT	$3,061,198.19
INDUSTRIAL	PRESCRIPTIVE MOTORS	$2,398,661.59
COMMERCIAL AND INDUSTRIAL	SELF DIRECT	$2,355,728.49
INDUSTRIAL	CUSTOM DATA CENTERS	$2,176,218.24
COMMERCIAL	PRESCRIPTIVE PERFORMANCE CONTRACTING OR DSM BIDDING	$1,589,664.00
CROSS SECTOR	SHADING, COOL ROOFS	$940,354.41
CROSS SECTOR	VOLTAGE REDUCTION, TRANSFORMERS	$913,449.00
COMMERCIAL	FINANCING	$827,220.00
INDUSTRIAL	CUSTOM OTHER	$723,186.53
RESIDENTIAL	PRESCRIPTIVE POOL PUMP	$691,769.74
INDUSTRIAL	CUSTOM DATA CENTERS	$684,368.93
COMMERCIAL	PRESCRIPTIVE GROCERY	$646,862.98
RESIDENTIAL	PRESCRIPTIVE WATER HEATER	$641,252.97
INDUSTRIAL	CUSTOM REFRIGERATED WAREHOUSES	$510,400.00
COMMERCIAL	PRESCRIPTIVE IT AND OFFICE EQUIPMENT	$507,460.59
INDUSTRIAL	CUSTOM REFRIGERATED WAREHOUSES	$191,856.97
RESIDENTIAL	PRESCRIPTIVE WINDOWS	$45,000.00
INDUSTRIAL	SELF DIRECT	$3,505.73

Figure B-2 Canadian Electric Energy Efficiency Program Category Expenditures (in USD and CAD)

CUSTOMER CLASS	PROGRAM TYPE	2016 EXPENDITURES USD	2016 EXPENDITURES CAD
COMMERCIAL	OTHER	$142,385,938.84	$188,555,572.24
RESIDENTIAL	OTHER	$102,995,466.28	$136,392,464.32
INDUSTRIAL	CUSTOM INDUSTRIAL OR AGRICULTURAL PROCESSES	$38,173,546.76	$50,551,585.45
COMMERCIAL	PRESCRIPTIVE LIGHTING	$22,207,778.68	$29,408,805.75
COMMERCIAL	CUSTOM RETROCOMMISSIONING	$19,669,055.57	$26,046,883.97
LOW INCOME	LOW INCOME	$17,918,839.50	$23,729,148.13
INDUSTRIAL	OTHER	$15,822,227.94	$20,952,695.66
RESIDENTIAL	CONSUMER PRODUCT REBATE LIGHTING	$13,041,391.83	$17,270,154.05
COMMERCIAL	STREET LIGHTING	$10,586,311.81	$14,018,997.23
RESIDENTIAL	BEHAVIORAL, ONLINE AUDIT, FEEDBACK	$8,021,970.81	$10,623,150.78
COMMERCIAL	PRESCRIPTIVE HVAC	$6,735,169.99	$8,919,095.81
COMMERCIAL	NEW CONSTRUCTION	$6,645,235.78	$8,799,999.81
CROSS SECTOR	OTHER	$6,003,366.42	$7,949,999.83
RESIDENTIAL	WHOLE HOME AUDITS	$5,776,172.60	$7,649,136.84
RESIDENTIAL	CONSUMER PRODUCT REBATE APPLIANCES	$5,512,651.93	$7,300,167.76
CROSS SECTOR	PLANNING, EVALUATION, OTHER PROGRAM SUPPORT	$5,399,254.07	$7,149,999.85
COMMERCIAL AND INDUSTRIAL	PRESCRIPTIVE	$4,704,524.88	$6,229,999.87
RESIDENTIAL	WHOLE HOME RETROFIT	$4,530,842.58	$5,999,999.87
CROSS SECTOR	CODES AND STANDARDS	$3,928,995.66	$5,202,999.89
COMMERCIAL AND INDUSTRIAL	CUSTOM	$3,050,767.34	$4,039,999.91
COMMERCIAL AND INDUSTRIAL	OTHER	$2,159,701.63	$2,859,999.94
RESIDENTIAL	PRESCRIPTIVE HVAC	$1,714,060.77	$2,269,856.93
RESIDENTIAL	APPLIANCE RECYCLING	$1,619,156.75	$2,144,179.62
INDUSTRIAL	CUSTOM OTHER	$1,611,469.68	$2,133,999.95
COMMERCIAL	SMALL COMMERCIAL PRESCRIPTIVE	$1,316,934.76	$1,743,960.04
COMMERCIAL	CUSTOM OTHER	$1,216,947.31	$1,611,550.97
RESIDENTIAL	NEW CONSTRUCTION	$1,108,555.20	$1,468,011.95
INDUSTRIAL	PRESCRIPTIVE MOTORS	$711,719.86	$942,499.98
RESIDENTIAL	PRESCRIPTIVE INSULATION	$627,872.08	$831,463.98

CUSTOMER CLASS	PROGRAM TYPE	2016 EXPENDITURES USD	2016 EXPENDITURES CAD
CROSS SECTOR	MARKETING, EDUCATION, OUTREACH	$496,368.15	$657,318.99
RESIDENTIAL	WHOLE HOME DIRECT INSTALL	$340,568.33	$450,999.99
COMMERCIAL	SMALL COMMERCIAL CUSTOM	$308,097.30	$407,999.99
COMMERCIAL	PRESCRIPTIVE OTHER	$144,986.96	$192,000.00
INDUSTRIAL	PRESCRIPTIVE OTHER	$75,514.04	$100,000.00
COMMERCIAL	OTHER	$142,385,938.84	$188,555,572.24
RESIDENTIAL	OTHER	$102,995,466.28	$136,392,464.32

Appendix C Electric Demand Response Program Expenditures

In 2013, CEE modified the demand response program categories to align with those used by FERC. FERC defines several demand response program types and groups them into two major categories:

- Incentive-based programs, which tend to involve incentives for contracting with utilities to curtail load when necessary
- Time-based programs, which generally employ graduated pricing schemes that incent customers to reduce load during system peaks

US Electric Demand Response Program Category Expenditures

Approximately three-quarters of 2016 demand response program expenditures went to incentive-based programs, as shown in Figure C-1 below. Of those expenditures, nearly half, 46 percent, went to direct load control programs, followed by interruptible load at 25 percent, "other" incentive-based programs at 20 percent, emergency demand response at four percent, load as a capacity resource at four percent, and demand bidding and buyback at one percent. (See Figure C-2.) Relative rankings within incentive-based program are similar to last year's. Most investment flowed to direct load control programs within incentive-based demand response programs, increasing from 43 to 46 percent of the total. Interruptible load programs decreased for the second year in a row from 31 to 25 percent of reported expenditures. This year "other" incentive-based programs increased from 10 to 20 percent of spending, driven by several program administrators that were unable to break out incentive expenditures in 2017 as they did in 2016.

Two percent of demand response expenditures went to time-based programs, consistent with last year's results. Of this spending, 57 percent was allocated to peak time rebate programs, 24 percent to real time pricing, and 19 percent to time of use pricing. The increased granularity of time-based pricing provided this year is due to twice as many US program administrators reporting 2016 expenditures for time-based programs, and the consistent share of this program category indicates that the 11 percent increase in US demand response spending overall was distributed proportionally between incentive and time-based programs.

Figure C-1 2016 US Electric Demand Response Expenditures: General Categorization

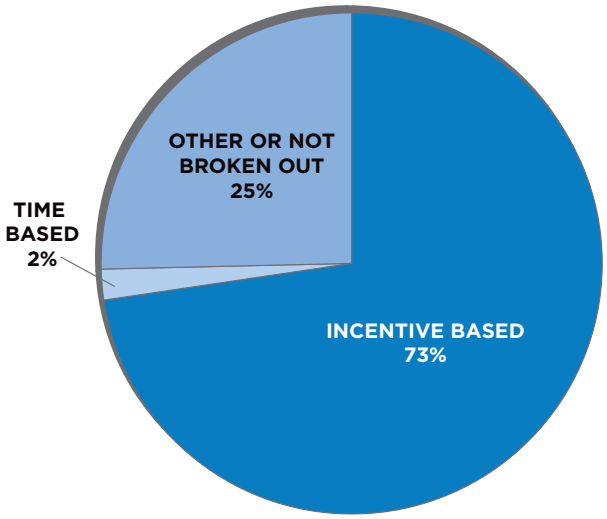


Figure C-2 2016 US Electric Demand Response Expenditures: Incentive-Based Programs

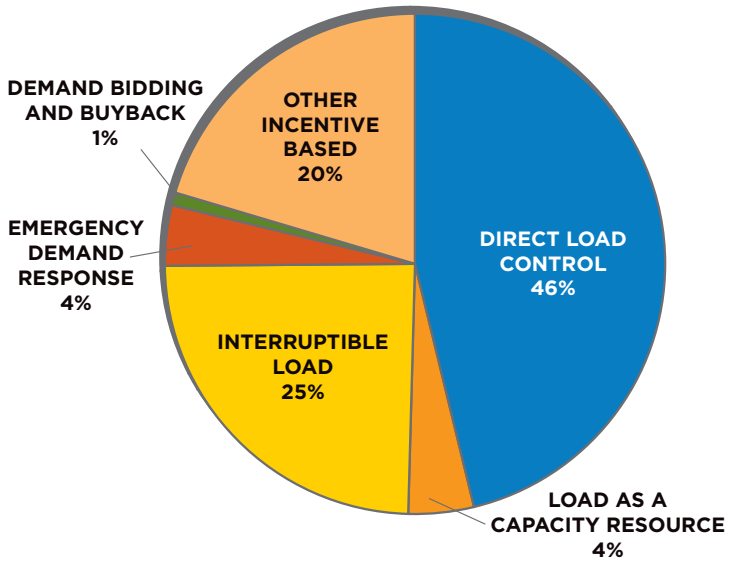
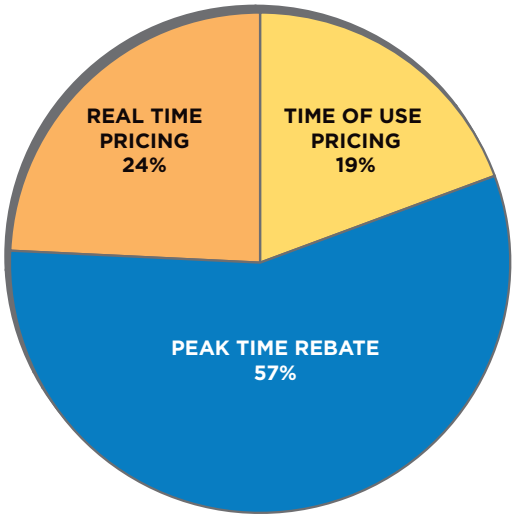


Figure C-3 2016 US Electric Demand Response Expenditures: Time-Based Programs



Canadian Electric Demand Response Program Category Expenditures

In 2014 and 2015, thanks to a submission from a large Canadian program administrator, CEE was able to provide a rough breakdown of demand response program expenditures into high level FERC categories. In 2017, CEE received a partial response from this program administrator, suggesting that their demand response programs may be increasingly run within the wholesale capacity markets. While CEE further investigates this development and the potential of a broader industry trend, their previous demand response spending was carried through in this analysis as "not broken out" and as such cannot be disaggregated here. That said, in line with past reporting practices, should it be found that this was an inaccurate representation of 2016 demand response expenditures at this organization, the information will be retroactively adjusted in subsequent releases.

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