CEE Annual Industry Report

# 2016 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 an annual time series analysis, a point in time report for the US and Canadian program industry on trends in 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 budget, 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, portrays an accurate representation of 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 our collaborator, the 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 our collaborator have sought greater consistency in data collection from respondents over the years, however, the accuracy of the data are 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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Also, please state clearly in your analysis that whereas you are "using CEE data, the analysis is yours alone."

# EXECUTIVE SUMMARY

This report concludes CEE's eleventh consecutive 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 2016 budget data[1] and 2015 expenditure and impact[2] data compared to previously reported figures to assess industry growth and observe significant changes.

In 2016, 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[3] (DSM) program expenditures. In 2015, combined spending on gas and electric DSM programs across the United States and Canada totaled over $8.7 billion from all sources and $8.2 billion from ratepayers. Industry expenditures are relatively stable compared to 2014 expenditures from all sources (a less than one percent increase) and represent an 18 percent increase over the last five years. CEE member programs accounted for almost $7.0 billion, or 80 percent, of these expenditures. US and Canadian DSM ratepayer-funded programs are estimated to have saved approximately 29,588 GWh of electricity and 496 million therms of gas in 2015, which represents 23.4 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**

- US and Canadian combined gas and electric DSM program budgets from ratepayer funds totaled over $8.8 billion out of the $9.2 billion budgeted from all sources. This represents a three percent decrease from 2015 ratepayer-funded budgets. Upon further investigation, CEE concluded that

[1]The budget data from survey respondents were collected during the summer and fall of 2016. 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]DSM encompasses both energy efficiency (EE) and demand response (DR) programs.

[4]Calculated using the EPA Greenhouse Gas Equivalencies Calculator, "Greenhouse Gas Equivalencies Calculator," Environmental Protection Agency, accessed March 2017, epa.gov/energy/greenhouse-gas-equivalencies-calculator.

the primary drivers of this decrease in program budgets include the recent weakening of the Canadian dollar relative to the US dollar and significant changes to program plans (and accompanying budgets) for a few large program administrators in the United States.

- US and Canadian program administrators spent nearly $958 million from all sources—almost $943 million of which came from ratepayers—on demand response programs in 2015, representing decreases of eight percent and nine percent, respectively, as compared to 2014.
- Natural gas program expenditures in the United States and Canada rose three percent between 2014 and 2015, to just over $1.42 billion from $1.38 billion.
- The largest sources of nonratepayer funding budgeted for 2016 US electric DSM activity included the Regional Greenhouse Gas Initiative (2.55 percent of total budgets) and wholesale capacity market revenues (1.17 percent). 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 $8.0 billion from all sources and over $7.5 billion from ratepayers in 2015, representing an increase of one percent for expenditures from all sources and a decrease of less than one percent for ratepayer funding as compared to 2014, after adjusting for inflation.
- This total represents a 17 percent increase in US DSM inflation-adjusted expenditures over the last five years.
- US DSM expenditures in 2015 represented nearly 0.05 percent of US GDP and 2.81 percent of value added[6] by the US utility industry.
- Ratepayer-funded programs resulted in 26,058 GWh of gross incremental electric savings and 385 million therms of gas savings in 2015.

[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 2017, bea.gov/faq/index.cfm?faq_id=184.

**Gas and Electric DSM in Canada**

- Canadian gas and electric DSM program expenditures fell to $671 million USD in 2015, a ten percent decrease compared to 2014 expenditures. However, this decrease is largely driven by a falling CAD to USD exchange rate, as Canadian DSM expenditures in 2015 totaled over $860 million CAD, a four percent increase over 2014. While Canadian DSM expenditures have remained consistent over the last several years, mostly staying around $800 million USD since 2010, 2015 had the highest reported CAD expenditure total seen throughout the history of this report.
- Canadian DSM expenditures in 2015 represented 0.05 of Canadian GDP and two percent of value added by the Canadian utility industry.
- In 2015, ratepayer-funded DSM programs resulted in 2,997 GWh of gross incremental electric savings and 111 million therms of gas savings.

This is the eighth 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 2016 report reflects data for 321 utility and nonutility program administrators[7] operating efficiency programs in all 50 US states, the District of Columbia, and nine Canadian provinces. More information regarding the 2016 data collection process can be found in section 2.2.

[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/.

# CONTENTS

# FIGURES

# 1 Introduction

Over the past eleven 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 2011 to 2015, US and Canadian combined gas and electric DSM inflation-adjusted expenditures have increased 17 percent. Regardless of uncertainty regarding the instatement of proposed national policies, such as the Clean Power Plan,[1] the sustained US and Canadian investment summarized in this report supports the effectiveness 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 2015 program expenditures and savings and 2016 budgets reported by US and Canadian DSM program administrators, both electric and natural gas. A total of 321 utility and nonutility program administrators operating efficiency programs in all 50 US states, the District of Columbia, and nine Canadian provinces are included in this year's report.[2]

[1]The Clean Power Plan seeks to reduce carbon dioxide emissions from existing power plants under the Clean Air Act section 111(d). The Clean Power Plan promotes energy efficiency as a demonstrated, cost-effective method states can incorporate into their implementation plans to meet carbon emission reduction targets. "FACT SHEET: Energy Efficiency in the Clean Power Plan," US Environmental Protection Agency, accessed March 2017, epa.gov/cleanpowerplan/fact-sheet-energy-efficiency-clean-power-plan.

[2]CEE improved the way we track and define response rates starting with the 2014 report. See Section 1.2 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 1.2.

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 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 2016 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, describes the report's methodology and includes 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 2016 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.[3] 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 2016, in conjunction with the American Gas Association (AGA).[4,5] 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

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

[4] 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.

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

regulatory information. Please contact AGA directly for more on these publications, which are available on their website.

CEE administers this survey annually via an online survey[6] 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,[7] nonmembers who were expected to have significant DSM programs, and some program administrators who submitted data to the Energy Information Administration (EIA).[8] 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 include comparisons of only those respondents who provided information in both 2015 and 2016, 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

[6]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.

[7]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.

[8]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 48 million Americans. For more information about APPA or its members, please visit www.publicpower.org.

unreported information for program administrators who we expected to have significant DSM budgets, expenditures, or savings.

In 2016, this report reflects data for 321 utility and nonutility program administrators operating DSM programs in 50 US states, the District of Columbia, and nine Canadian provinces. These figures include those organizations accounted for using the streamlined analysis described in the next paragraph. However, this year CEE and AGA also worked together to correct a categorization error that was mistakenly incorporating nonresponsive organizations in the responding organization total, and that correction is driving the apparent decrease in total organizations from 2015 (which listed 361 organizations). After accounting for the categorization error, this 2016 report describes budget, expenditure, and impact information for 3 additional respondents 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 2015 and 2016.

## 2.2 2016 Data Collection Methodology Change

Also, new this year, 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)[9] 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 six percent of total US and Canadian electric DSM expenditures in 2016, 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 few large program administrators that did not respond in 2016, so as to estimate program activity rather than allow totals for these administrators to fall to zero. Larger organizations for which CEE carried through previously provided information account for less than six percent of total US and Canadian electric DSM expenditures and roughly four percent of US and Canadian natural gas expenditures.

[9]Data from the 2015 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/.

## 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.[10] 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.[11] 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 2016 budgets and 2015 expenditures and savings attributable to ratepayer funds only.

[10] Only natural gas program expenditures and savings derived from ratepayer dollars are identified in this report. In all, gas program administrators reported that 98.4 percent of expenditures in 2015 were made using ratepayer funding. One hundred percent of natural gas savings reported to CEE and AGA were presumably derived from ratepayer funding. Section 2.7, below, addresses nonratepayer sources of funding in 2016 budgets.

[11] More specifically, CEE clarified in the 2016 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 2016 and total program expenditures and savings for 2015 that aligned with calendar years. CEE defined the budget year for this survey effort as beginning on January 1, 2016 and ending on December 31, 2016. Similarly, CEE defined the "expenditure and savings year" for this survey effort as beginning on January 1, 2015 and ending on December 31, 2015.

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 2016 industry budget figures and some portion of the 2015 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 2016 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 the 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.[12] CEE has incorporated questions into the survey that ask respondents

[12]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.[13] In 2016, as in 2015 and 2014, 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 in 2016, which are consistent with the categories used in the previous three years.

As in past years, CEE based demand response program categories on those specified and defined by the US Federal Energy Regulatory Commission (FERC).[14] 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

[13] 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.

[14] 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.

that improvements resulting from the switch to an online survey format have reduced errors over the past several years.

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 2016, such as those due to newly approved programs or budget cuts. In addition, carryover of unspent funds from 2015 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,[15] and real Canadian dollars were calculated using the Bank of Canada CPI Inflation Calculator.[16] This report uses an average annual exchange rate of 0.7804 USD = 1 CAD for the 2015 expenditure and savings information (an average of the daily Federal Reserve[17] exchange rate for January 1, 2015–December 31, 2015) and an average annual exchange rate of 0.7504 USD = 1 CAD for the 2016 budget information (an average of the daily Federal Reserve exchange rate for January 1, 2016–June 15, 2016).

## 2.8 Corrections to 2015 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 2015 survey responses, no such changes were made in 2016.

# 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 over $9.2 billion in 2016, representing a decrease of two percent from 2015 (Figure 1).[18] Data analysis revealed that this decrease is primarily attributable to a range of small to moderate decreases across the majority of Canadian electric program administrators (largely driven by a weakening of

[15] "CPI Inflation Calculator," Bureau of Labor Statistics, accessed February 26, 2017, http://www.bls.gov/data/inflation_calculator.htm.

[16] "Inflation Calculator," Bank of Canada, accessed February 26, 2017, http://www.bankofcanada.ca/rates/related/inflation-calculator/.

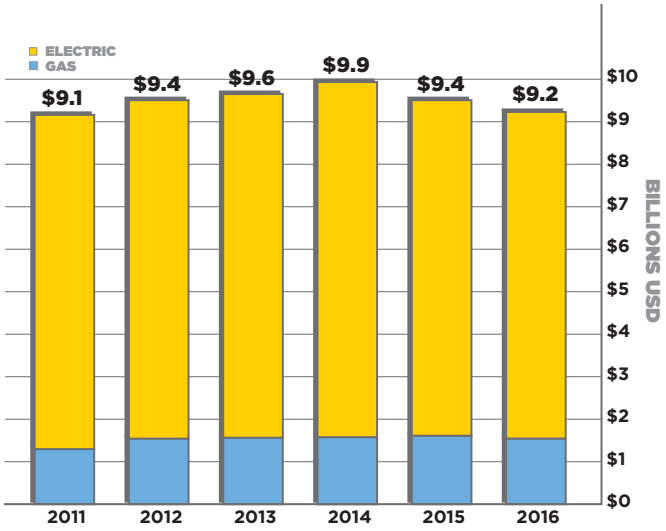
[17] "Canada—Spot Exchange Rate, Canadian $/US$," last modified March 13, 2017, http://www.federalreserve.gov/releases/h10/Hist/.

[18] 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.

the Canadian dollar relative to the US dollar) as well as significant decreases among a few large US electric program administrators. Overall, while both US and Canadian gas budgets increased slightly in 2016, those changes were exceeded by US and Canadian electric budget decreases.

Figure 1 US and Canadian DSM Program Budgets—Gas and Electric Combined 2011–2016




Budgets derived exclusively from ratepayer funds accounted for 96 percent, over $8.8 billion, of the total 2016 budget figure. Figure 1 does not isolate demand response budgets, though in 2016 they represent just under 10 percent of both the total DSM budgets from all sources, about $883 million, and the ratepayer-funded DSM budgets, about $862 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 remained stable from 2015 to 2016. Overall decreases in program budgets in 2015 and 2016 have now reversed the increases seen from 2011 to 2014.

## 3.2 Funding Sources

In 2016, ratepayer dollars constituted 93.32 percent of funding for electric DSM programs in the United States. Remaining sources of funding included the Regional Greenhouse Gas Initiative (2.55 percent), wholesale capacity markets (1.17 percent), and the Weatherization Assistance Program (0.16 percent), in addition to unidentified sources (2.79 percent). Regional Greenhouse Gas Initiative (RGGI) funding constituted seven percent of the total funding reported in the RGGI states, consistent with the 2015 results and up from three percent of funding for these states in 2014.

In 2016, ratepayer dollars constituted 99.96 percent of funding for natural gas energy efficiency programs in the United States. The remaining 0.04 percent was derived from unidentified sources.

In 2016, 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 over reported 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.

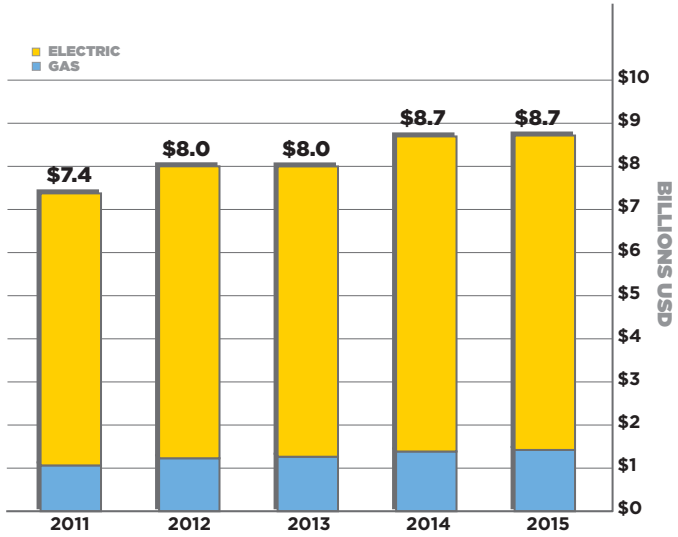
Roughly 41 percent of cycle budgets reported in this year's survey extend past the end of 2016—15 percent will end in 2017, 19 percent in 2018, and seven percent in 2019 or after. Approximately 59 percent of the cycle budgets reported were for only one year or, if they were for multiple years, ended in 2016. 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 $8.7 billion in 2015 (an increase of less than one percent over 2014), including $8.2 billion in expenditures from ratepayer funds (a decrease of slightly greater than one percent compared to 2014). The real difference between 2014 and 2015 is similar, with total DSM expenditures increasing just over one percent from all sources and decreasing less than one percent from ratepayer-funded programs 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 2011–2015




Although not isolated in Figure 2, demand response expenditures represent 11 percent of total expenditures in 2015 regardless of funding source. This is slightly less than the proportion of total DSM expenditures spent on demand response in 2014, 12 percent, which was itself less than the proportion spent on demand response in the previous three years, when demand response accounted for between 13 and 14 percent of total DSM program expenditures. This decrease in the proportion of DSM expenditures spent on demand response is consistent with a similar trend for demand response budgets.

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.[19] As explained in 2.1, despite our best efforts, Figure 2 does not depict expenditures year after year from the exact same pool of survey respondents.[20] However, the streamlined survey process described in section 2.1, whereby 2016 electric responses were supplemented with other information sources, in part resulted in an exceptionally similar pool of electric program administrators between the 2015 and 2016 survey years. Therefore, throughout this report, all year over year comparisons between respondents in

[19]Please note that as the CEE survey panel 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.

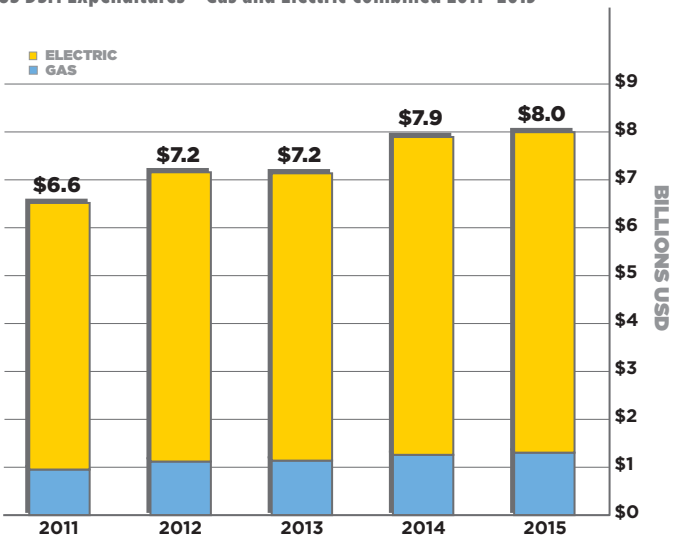
[20]As stated in section 1.2, where appropriate, CEE will provide supplemental analyses that include comparisons of only those respondents who provided information in both 2015 and 2016, alongside the analyses of all data collected, because responding organizations may vary from year to year. Thus, the year to year changes in the historical trend graphs cannot be entirely attributed to new or expanded programs and to new program administrators.

the 2015 and 2016 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 2015 and 2016 surveys, expenditures were nearly stable (down 0.13 percent).[21] Reported DSM budgets were also relatively stable in 2016 (down 0.74 percent compared to 2015), and so despite slight decreases, these comparisons indicate continued expenditures in the energy efficiency program industry beyond the effects of drop-offs or new respondents between the 2015 and 2016 survey years.

## 3.5 United States DSM Trends

US administrators spent over $8.0 billion[22] from all sources for gas and electric DSM programs in 2015. Similar to Figure 1, this total includes both energy efficiency and demand response.

Figure 3 US DSM Expenditures—Gas and Electric Combined 2011–2015




2015 gas and electric DSM expenditures in the United States increased one percent over 2014 expenditures, both in nominal dollars and when adjusted for inflation. Over the past five years, US inflation-adjusted DSM expenditures have increased 17 percent. When comparing only those program administrators who responded to both the 2015 and 2016 surveys, expenditures from all sources increased by over $54 million, or 1.54 percent.

[21] Survey respondents that provided both 2014 and 2015 expenditure data spent $9.5 million more on DSM programs in 2014 than in 2015.

[22] $7.5 billion of these expenditures were derived solely from ratepayers, an approximately 0.5 percent decrease from 2014 in both nominal dollars and when adjusted for inflation.

The $8.0 billion spent by US DSM program administrators represents 0.044 percent of 2015 US gross domestic product and 2.81 percent of the value added by the US utility industry to gross domestic product in 2015. DSM expenditures were closest in scope to the value added by the "apparel and leather and allied products" industry, $10.0 billion.[23]

Although not depicted in Figure 3 above, in 2016, natural gas and electric DSM program administrators in the United States budgeted nearly $8.5 billion from all sources, representing a decrease of one percent as compared to 2015 when adjusted for inflation.

### 3.5.1 United States Electric DSM Trends

In 2015, US program administrators spent over $6.7 billion on electric DSM programs, a 0.83 percent increase compared to 2014 expenditures, indicating a relatively stable level of spending at the national level.[24,25] Figure 4 below presents the breakdown of US electric expenditures from 2011 to 2015 by customer class, which, from 2012 onward, represents the sum of either program level data rolled up to customer classes or customer class data provided directly by respondents. "Not broken out"[26] contains data that program administrators could not allocate to a specific program or customer class.

Notably, in 2015 commercial and industrial expenditures were up 11 percent compared to 2014. The only other category to increase was low income (one percent), though these gains were offset by decreases in cross-sector spending (down 18 percent) and demand response spending (down eight percent). The proportion of expenditures captured in the not broken out category remains high in 2015 (though down six percent from 2014) due to responses from several large program administrators that provided a breakdown of spending in 2013 but not in 2014 or 2015.

[23] 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: January 19, 2017.

[24] In 2015, $6.2 billion of the total expenditures were derived solely from ratepayer funds. When adjusted for inflation, this represents a slight decrease of one percent compared to the proportion of expenditures from ratepayers in 2014. In 2014, 94.4 percent of expenditures came from ratepayer funds, and in 2015, 92.6 percent of expenditures were derived from ratepayer funds.

[25] According to the US Bureau of Labor Statistics, the inflation rate from 2014 to 2015 was negligible, so inflation adjusted expenditures are not listed within the body of in this section. "CPI Inflation Calculator," Bureau of Labor Statistics, accessed March 2017, https://www.bls.gov/data/inflation_calculator.htm.

[26] 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 2011-2015

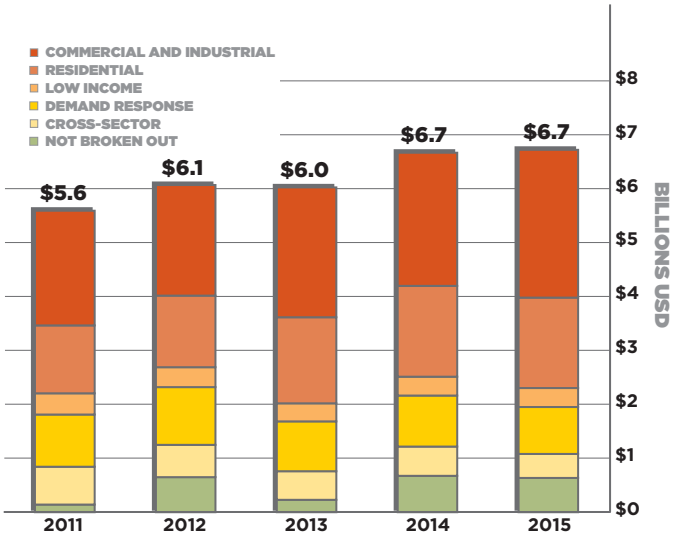
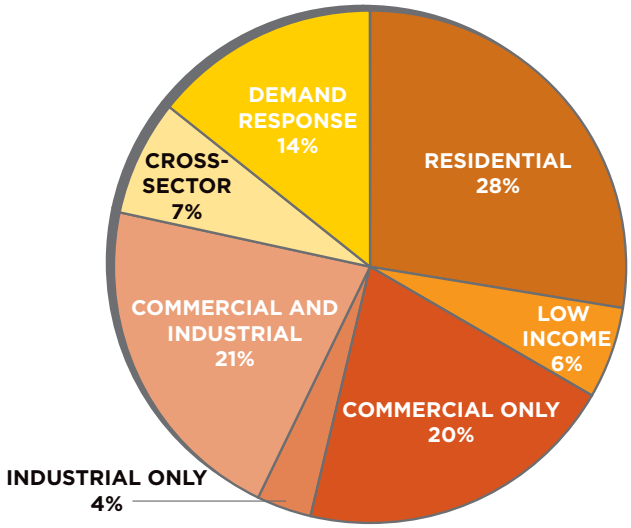



Figure 5 provides a more granular breakdown of 2015 US electric expenditures from all sources by customer class, with the "not broken out" class removed and with commercial and industrial spending separated into commercial, industrial, and C&I classes. Continuing the trend from previous years, the data illustrate that commercial and industrial efficiency programs received the largest share of electric program funding in the United States, comprising 45 percent of 2015 US electric DSM expenditures (up four percent from 2014). The residential sector received the second largest share of 2014 DSM electric expenditures, 28 percent. Demand response also maintained a sizable portion of expenditures at 14 percent, followed by cross sector, seven percent, and low income programs, six percent.

Figure 5 2015 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 2015 US Electric Energy Efficiency Expenditures by Category

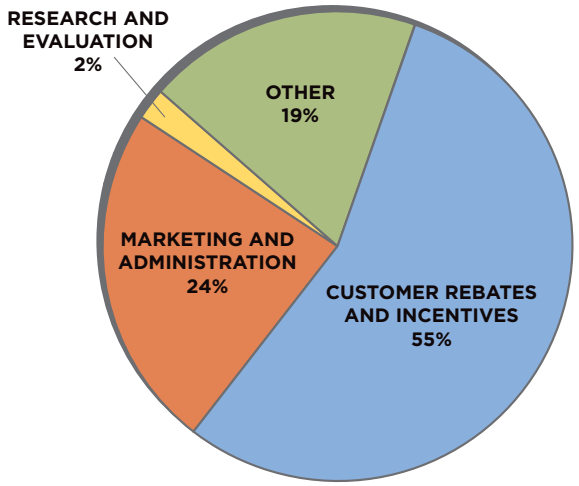



Figure 6 provides an overview of how US program administrators currently allocate electric energy efficiency program expenses, regardless of the targeted customer class. As in the past three years, customer rebate and incentive expenditures, sometimes classified as direct program costs, represented over half of US electric energy efficiency expenditures in 2015. Marketing and administration expenditures—often referred to as indirect program costs—represented 24 percent of 2015 energy efficiency program expenditures in the United States, a slightly higher proportion than in 2014, which was slightly higher than in 2013. The "other" category—making up 19 percent of 2015 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 2015 and 2016 spent roughly 93 percent of the ratepayer funds that were budgeted for electric DSM in 2015. This percentage is notably higher than the 76 percent of budgeted ratepayer funds spent among US program administrators that responded to the survey in both 2015 and 2014, though more in line with the 85 percent of budgeted ratepayer funds spent among US program administrators that responded to the 2014 and 2013 surveys.

### 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[27] (please refer to Section 2.4 for more details on program categories). 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 105 US program administrators who participated in the 2016 electric survey, 96 percent provided program level energy efficiency or demand response expenditures. When data reported at the program level is aggregated by customer class, these data indicate an expenditure breakdown similar to that in Figure 5, which represents all 2015 expenditure data reported in the 2016 survey and includes the remaining four percent of electric DSM expenditures not reported on the program level. Therefore, we conclude that the program level 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 38 percent of all the program level energy efficiency expenditures reported by respondents. Demand response program expenditures are not listed in this report but are discussed in general in Appendix C

**Figure 7 Most Common US Electric Energy Efficiency Program Types by 2015 Expenditures**

| CUSTOMER CLASS | PROGRAM TYPE | 2015 EXPENDITURES |
|---|---|---|
| **COMMERCIAL AND INDUSTRIAL** | MIXED OFFERINGS | $530,446,648 |
| **LOW INCOME** | | $353,239,376 |
| **COMMERCIAL** | GOVERNMENT, NONPROFIT, MUSH1 | $300,604,904 |
| **COMMERCIAL AND INDUSTRIAL** | PRESCRIPTIVE | $273,573,524 |
| **RESIDENTIAL** | CONSUMER PRODUCT REBATE FOR LIGHTING | $248,405,635 |
| **COMMERCIAL** | SMALL COMMERCIAL PRESCRIPTIVE | $147,568,596 |
| **RESIDENTIAL** | WHOLE HOME RETROFIT | $139,518,306 |

*MUSH refers to municipal, university, school and hospital.

As compared to 2014 program expenditures, Figure 7 indicates that survey respondents reported an increased amount of spending on commercial and industrial mixed offerings programs for the second year in a row, and 2015 expenditures in this category were 20 percent higher than in 2014. Consistent with previous years, prescriptive and custom programs in the commercial and

[27] CEE incorporated program level questions for the electric survey only. 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.

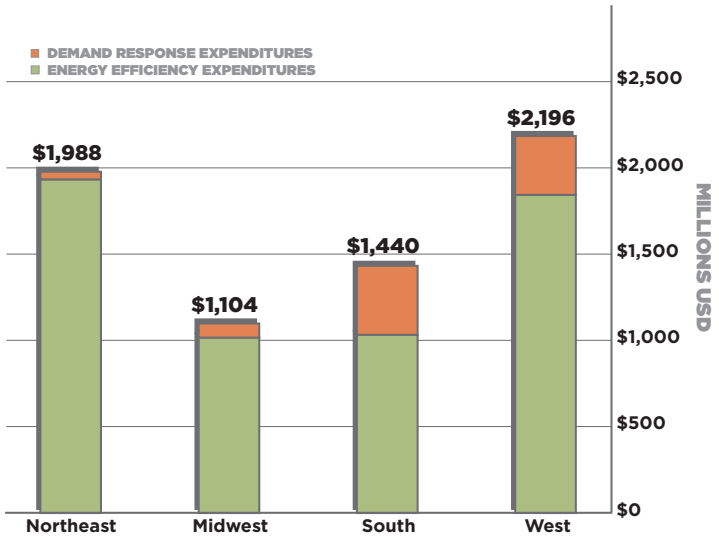
 

industrial classes constitute a significant portion of the program category expenditures provided, as do low income and residential lighting programs. New this year, 2015 residential HVAC program spending (down 24 percent from 2014 to 2015) fell from the list to be replaced by residential home retrofit programs (up two 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 63 percent of electric program administrators who reported 2015 energy efficiency program expenditures also provided demand response expenditures, which suggests that the majority of US electric survey respondents administer both energy efficiency and demand response programs. Demand response expenditures represent 14 percent of US electric DSM expenditures in 2015 (see Figure 5), a percentage consistent with 2014. However, while the proportion of spending remains the same, spending on demand response from all sources decreased approximately eight percent when adjusted for inflation, to $870 million in total.[28] While changes in one large program administrator drove approximately half of this decrease, when looking at the overall pool of 2016 respondents with demand response programs, 61 percent reported demand response expenditure decreases in 2015, while 39 percent reported increases.

**Figure 8 US Electric Energy Efficiency and Demand Response Expenditures by Region, 2015**




[28] 2015 US electric demand response expenditures totaled over $855 million from ratepayer funded sources only. This represents a nine percent decrease from 2014, with or without adjusting for inflation.

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 2015 (46 percent), followed by the West (39 percent), Midwest (nine percent) and Northeast (five percent). The Northeast experienced the greatest growth, however, both in dollar terms ($5 million additional spend) and in terms of percentage change (12 percent), while the Midwest saw some growth as well ($1 million additional spend, an increase of one percent compared to 2014). Despite remaining the two most prominent regions for demand response spending, both the South and West saw decreases in overall spending of two and 18 percent respectively. In the West, this change was driven primarily by two large demand response program administrators, though nearly all organizations running these programs in the region indicated a decrease of some degree.

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.

### 3.5.4 United States Natural Gas Trends

This section discusses natural gas energy efficiency program expenditures in the United States.[29] Figure 9 shows that gas program expenditures for energy efficiency programs in the United States continued to increase in 2015. US gas program administrators spent $1.29 billion on natural gas efficiency programs in 2015, which represents a two percent increase over 2014 expenditures and a 28 percent increase over 2011 when adjusted for inflation.

Figure 9 also presents the magnitude of expenditures from 2011 to 2015 by customer class.[30] The customer class breakdown of 2015 natural gas expenditures is nearly identical to that of 2014 expenditures. Residential programs continue to represent the largest share of expenditures in 2015 at 39 percent. Low income and C&I programs follow, accounting for 27 percent and 21 percent of expenditures respectively. A two percent drop in multifamily

[29] Please note that natural gas programs are considered to be only energy efficiency programs. Natural gas demand response programs do not exist within the industry.

[30] For ease of comparison between years, 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, 2014, and 2015.

expenditures was offset by very slight increases in C&I and "other" expenditures.

Figure 9 US Natural Gas Expenditures 2011–2015

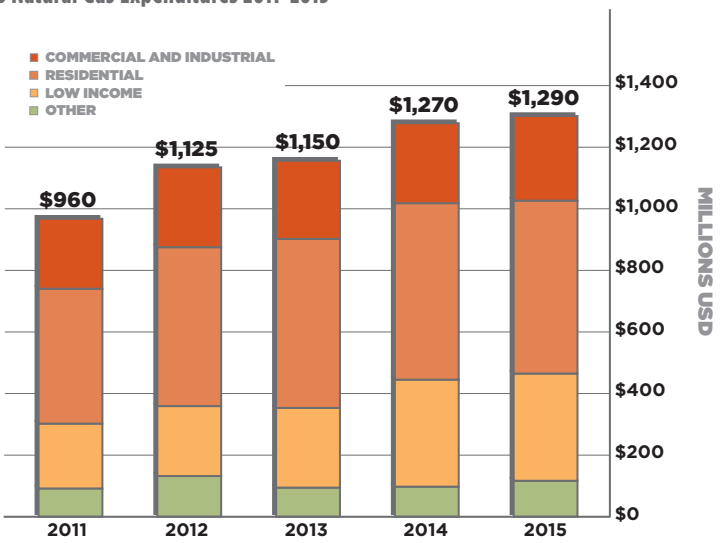



Figure 10 provides a more granular breakdown of 2015 US gas expenditures by customer class. For ease of comparison with previous years' reports and with a concurrent report by AGA, we did not break commercial and industrial into separate classes in Figures 9 and 10, but multifamily expenditures are separated from residential expenditures in Figure 10.

Figure 10 2015 US Natural Gas Expenditures by Customer Class

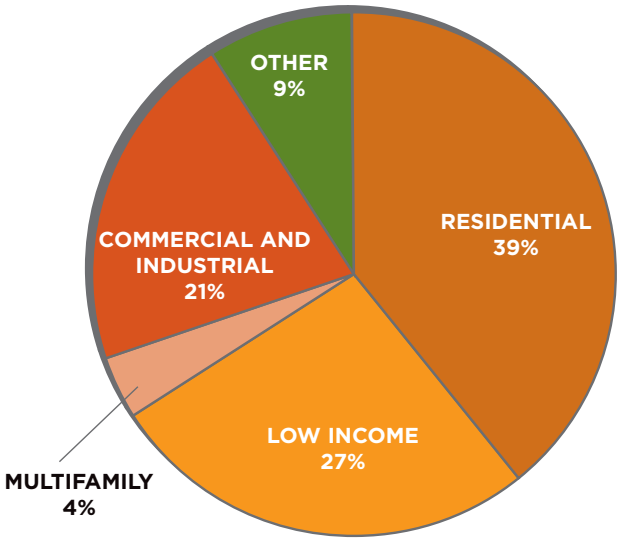
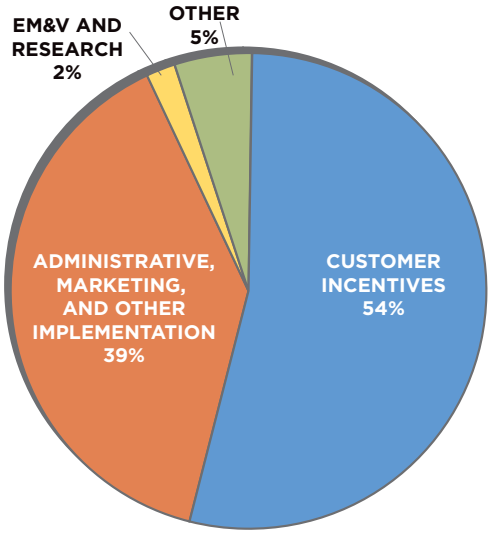


Figure 11 separates 2015 gas expenditures in the United States into expenditure categories, which are slightly different from the categories used for US electric programs.[31]

Figure 11 2015 US Natural Gas Expenditures by Category




Customer incentives represented more than half of expenditures in 2015 (54 percent) followed by administrative, marketing, and other implementation spending (39 percent). Research, evaluation, measurement, and verification accounted for two percent of the spending, while other expenditures accounted for five percent of spending. The other category contains all funds that could not be separated into the three specific categories. This breakdown remains consistent with the previous year's spending allocations.

Although not depicted in Figure 11 above, US natural gas program administrators budgeted slightly more than $1.5 billion for natural gas efficiency programs in 2016, which represents an increase of two percent from 2015 budgets. Considering just those program administrators who responded to the survey in both 2015 and 2016, programs spent 88 percent of the funds that were budgeted for natural gas programs in 2015.

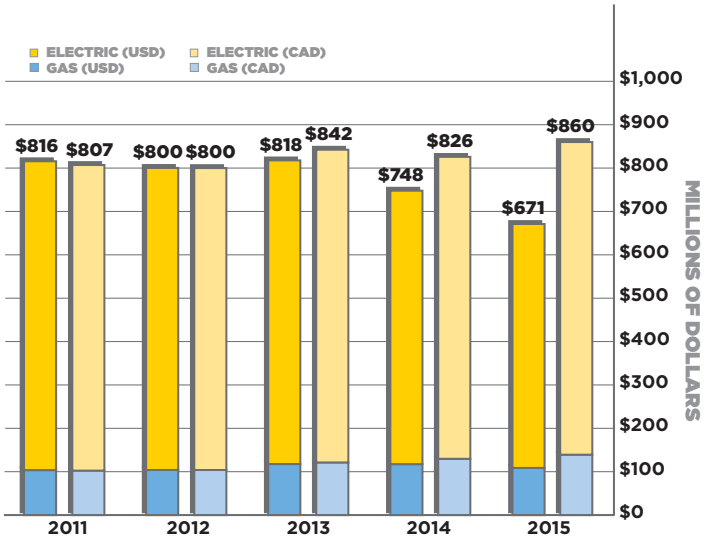
## 3.6 Canadian DSM Trends

In 2015, Canadian DSM expenditures decreased to $671 million USD; however, this change is largely driven by the weakening of the Canadian dollar relative to the US dollar in recent years, as CAD expenditures rose to $860 million in 2015. In USD, this represents a 10 percent decrease in expenditures as

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

compared to 2014, or an 11 percent decrease when adjusting for inflation.[32] In CAD, 2015 represents a four percent increase in expenditures as compared to 2014, or three percent when adjusting for inflation. Figure 12 below presents Canadian DSM expenditures—including both energy efficiency and demand response programs—from 2011 to 2015 in nominal US and Canadian dollars. In last year's survey, one large electric program administrator reported to CEE that a current energy surplus had caused them to curtail DSM activity slightly for the near future within their service territory, however 2016 results suggest that this curtailment has abated somewhat, as that organization's expenditures rose from 2014 to 2015. In addition, a separate Canadian electric program administrator reported information for the first time in several years, contributing to the overall increase shown from 2014 to 2015. Overall, Figure 12 illustrates that Canadian gas and electric DSM expenditures have remained relatively stable, if not increased moderately, over the past five years, suggesting consistent investment in the efficiency industry.

**Figure 12 Canadian DSM Expenditures—Gas and Electric Combined (2011–2015)**




The $860 million CAD spent by Canadian DSM program administrators represents 0.05 percent of 2015 Canadian GDP and two percent of value added by the Canadian utility industry in 2015. DSM expenditures were most comparable to the value added by the "engine, turbine and power transmission equipment manufacturing" industry ($815 million in 2015 Canadian dollars) and slightly smaller than the value added by the "railroad rolling stock manufacturing" industry ($895 million in 2015 Canadian dollars).[33]

[32] All Canadian program administrators reported 100 percent ratepayer funded expenditures in the 2016 survey.

[33] 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

In 2016, reporting natural gas and electric DSM program administrators in Canada budgeted over $756 million USD, or just under $1.01 billion CAD, to energy efficiency and demand response programs. In USD, this represents a decrease of approximately two percent compared to 2015 DSM budgets, though it represents a nearly five 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 provide program level data when possible. Respondents who were able to provide these data were asked to select a specific program type for each program (see 2.4 and Appendix A for more information); CEE then aggregates these data in order to report figures for customer class comparisons.

Canadian electric DSM expenditures totaled $562 million USD ($721 million CAD) in 2015, as shown in Figure 13.[34]

The $721 million CAD spent on electric DSM programs in Canada in 2015 represent a four percent increase from 2014 expenditures, a three percent increase when adjusting for inflation. Notable developments in 2015 include a 17 percent increase in the 2015 Canadian electric expenditures categorized as commercial and industrial, a decrease of 50 percent for those expenditures categorized as cross sector, as well as a 14 percent decrease in residential expenditures. However, despite notable changes when comparing individual categories year over year, the various categories continue to represent similar proportions of annual spend relative to each other. In 2011, CEE added the "not broken out" class to capture any expenditures program administrators could not allocate to individual customer classes,[35] which in some cases includes overall portfolio activities such as EM&V or administration and marketing.

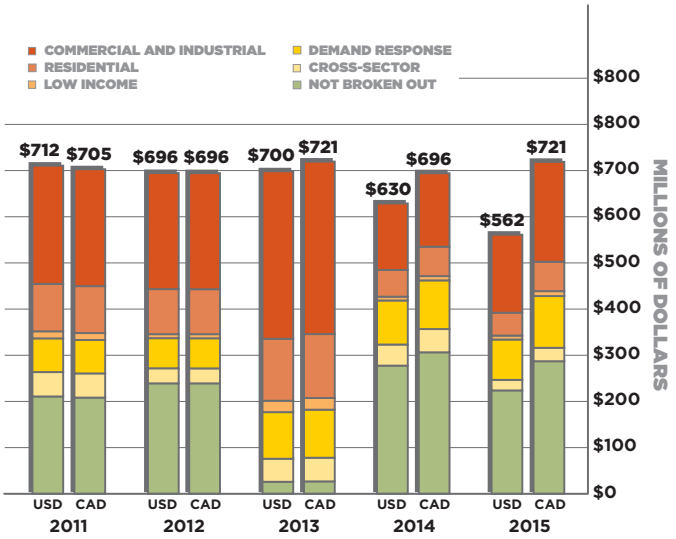
Classification System (NAICS), Monthly (table). CANSIM (database). Last updated March 1, 2017. http://www5.statcan.gc.ca/cansim/a01?lang=eng. (accessed March 2, 2017).

[34] Figure 13 combines the 2015 customer classes of commercial, industrial, and C&I into the "commercial and industrial" category. Where possible, these categories are separated out in Figure 14.

[35] See Section 2.4 above for more detail about the collection and differentiation of budgets, expenditures, and savings in the 2016 survey.

Figure 13 Canadian Electric DSM Expenditures 2011–2015




The expenditures allocated to the "not broken out" category decreased by 10 percent in 2015, as several respondents broke out previously unidentified spending. However, spending allocated to this category remains high relative to some past years due at least one large program administrator responding in 2011 and 2014 but not in 2012, 2013, 2015, or 2016. In these cases, CEE carried through the 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 2012, 2013, and 2015 data as an estimate in the "not broken out" category.

Figure 15 depicts 2015 Canadian electric DSM expenditures on a more granular level, broken out by customer class and excluding the "not broken out" category. In 2016, 40 percent of 2015 expenditures were reported as "not broken out;" thus, CEE cautions against making representations and comparisons regarding 2015 Canadian customer class breakdowns, since a significant portion of expenditure information was excluded from this analysis. Continuing the trend first seen last year, this view of 2015 expenditures illustrates that demand response programs constitute the largest spending class in Canada in 2015, with residential and commercial and industrial programs each representing relatively lower proportions 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. Based on further analysis, CEE believes this expenditure breakdown is largely attributable to the amount of expenditures reported as "not broken out" in

2015, similar to 2014. For example, while demand response expenditures represented the largest percentage of customer class expenditures in 2015, total demand response expenditures decreased overall for the second year in a row (further discussed in section 3.6.3).

Figure 14 2015 Canadian Electric DSM Expenditures by Customer Class

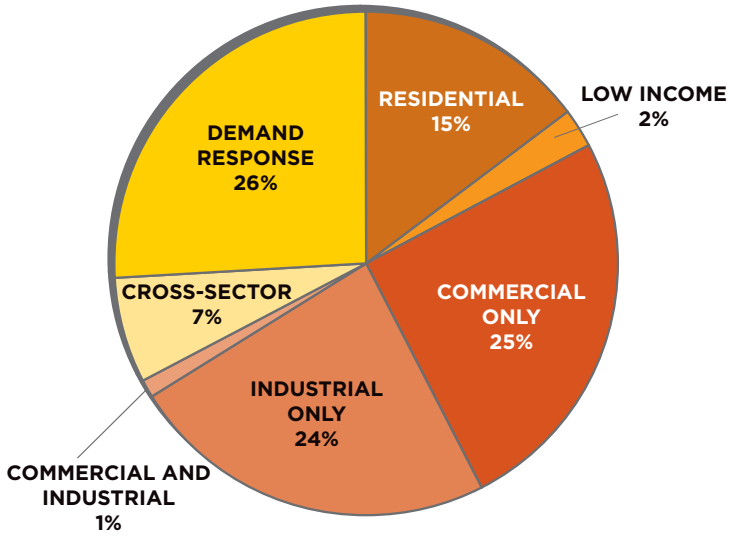
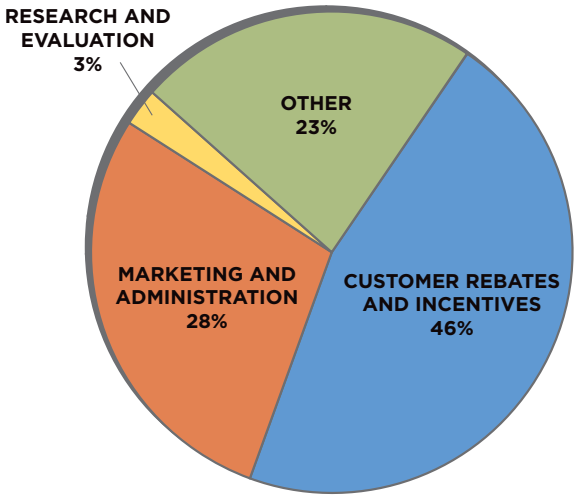



Figure 14 presents the classification of 2015 electric energy efficiency expenditures in Canada by cost category. Customer rebates and incentives represented just under half (46 percent) of 2015 expenditures, followed by marketing and administration (28 percent) and research and evaluation (three percent). The "other" category (23 percent), which contains all funds that could not be separated into the previous three categories, experienced an increase of nearly 300 percent compared to 2014. The spending increase in the "other" category is driven primarily by a single large Canadian program administrator that provided a detailed breakdown of their category spending in previous years but not in 2016. Analysis by CEE staff based on past responses from this organization suggests that had their expenditures been broken out by category, results would be more comparable to 2014, with nearly two-thirds of spending going towards rebate and incentive expenditures (though down slightly from 64 percent in 2014), one-third towards marketing and administration costs (up from 22 percent in 2014), and a similar percentage as shown here, three percent, going towards research and evaluation (down from six percent in 2014).

Figure 15 2015 Canadian Electric Energy Efficiency Expenditures by Category




Considering only those program administrators who responded to the survey in both 2015 and 2016, Canadian program administrators spent 98 percent of the ratepayer funds budgeted for electric DSM in 2015. This percentage is up from 65 percent in 2014, but is similar to levels seen in 2013 and 2012 (81 and 96 percent respectively).

Although not depicted in Figure 15 above, in 2016 Canadian program administrators budgeted over $635 million (over $848 million CAD) for electric DSM programs. One hundred percent of this funding came exclusively from ratepayers and represents an increase of six percent as compared to 2015 budgets when adjusted for inflation.

### 3.6.2 Canadian Program Level Electric DSM Expenditures

Since 2013, CEE has collected program administrator information at more granular categories for each electric customer class to begin to better understand what types of electric programs, and possibly what types of equipment, 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[36] (please refer to 2.5 for more details on program categories). These data, aggregated to customer class, indicate a breakdown similar to that in Figure 14, including data from two program administrators who were unable to provide information at the

[36]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.

program level and adjusting for the fact the majority of DR expenditures were not reported at the program level for Canada. Therefore, we conclude that the program level data we obtained in 2016 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 23 percent of all 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 2015 Expenditures**

| CUSTOMER CLASS | PROGRAM TYPE | 2015 EXPENDITURES (USD) | 2015 EXPENDITURES (CAD) |
|---|---|---|---|
| **COMMERCIAL** | STREET LIGHTING | $17,577,818 | $22,524,761 |
| **COMMERCIAL** | NEW CONSTRUCTION | $11,652,211 | $14,931,504 |
| **RESIDENTIAL** | CONSUMER PRODUCT REBATE - LIGHTING | $9,686,773 | $12,412,932 |
| **COMMERCIAL** | PRESCRIPTIVE LIGHTING | $9,143,431 | $11,716,677 |
| **CROSS SECTOR** | MARKETING, EDUCATION, AND OUTREACH | $8,533,583 | $10,935,198 |

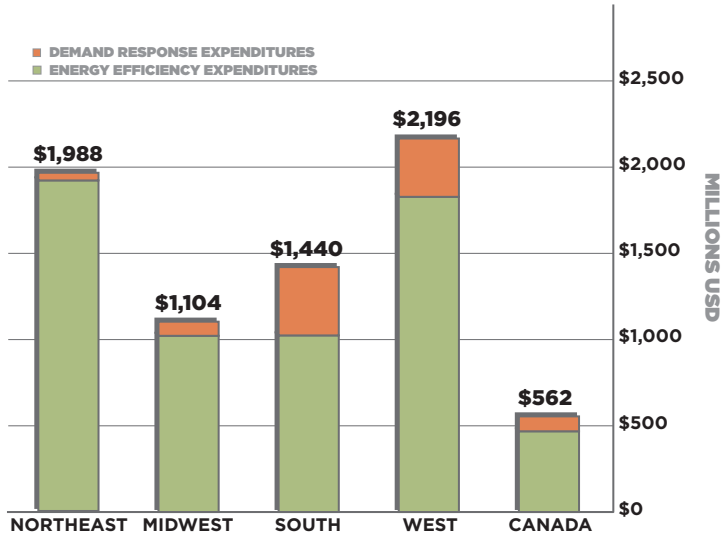
While not listed in Figure 16, two "other" categories, "Industrial Prescriptive—Other" and "Commercial Prescriptive—Other," were the two largest program categories of 2015 expenditures, jointly accounting for 66 percent of total program level expenditures. For a full disclosure of the Canadian electric 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 $87 million, or $112 million CAD, on their demand response programs in 2015, representing a six percent increase in CAD expenditures over 2014 (five percent when adjusting for inflation). Demand response accounted for 26 percent of total Canadian electric DSM expenditures (see Figure 14), or 16 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, 2015




The percentage of electric expenditures devoted to demand response programs in Canada is nearly identical to the percentage devoted to demand response in the Western United States and is slightly higher, in absolute terms, than the amount program administrators in the Midwestern United States spent on demand response in 2015. Similar to the 2015 report, Canadian demand response expenditures could not be broken out by program type this year. See Appendix C for more information.[37]

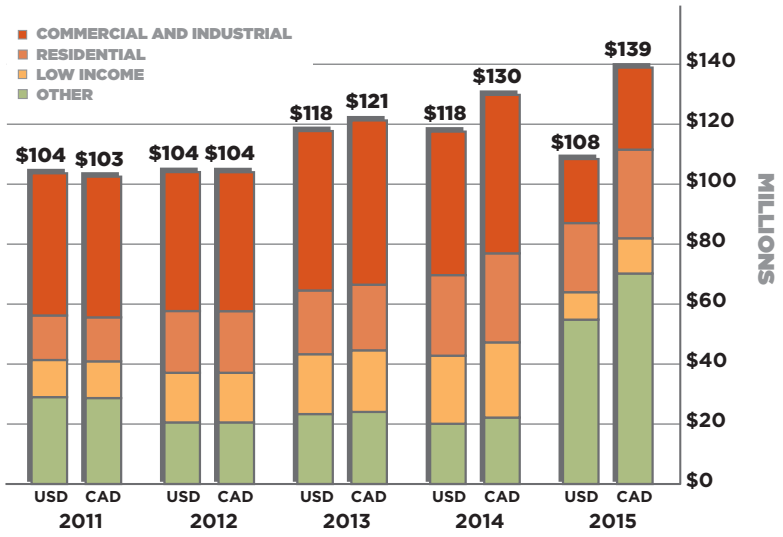
### 3.6.4 Canadian Natural Gas Trends

In 2015, Canadian natural gas program expenditures (in CAD) increased by seven percent compared to 2014 expenditures (six percent when adjusted for inflation). Figure 18 indicates that Canadian program administrators reported 2015 expenditures of $108 million, or $139 million CAD. As evidenced by the 28 percent increase in DSM expenditures since 2011, Canadian natural gas efficiency programs continue to grow. However, Figure 18 also reflects a significant departure from the fairly consistent breakdown between customer classes seen in recent years. In particular, there was a considerable increase in "other" expenditures in 2015. This increase is driven by information for two program administrators that responded in 2015 but not 2016 being carried through to this year's analysis, with their associated expenditures assigned to the "other" category. While these program administrators are included in

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

Figure 18 to prevent the expenditure totals from dropping arbitrarily, they are removed from the spending breakdowns shown in Figures 19 and 20.

**Figure 18 Canadian Natural Gas Expenditures 2011-2015**

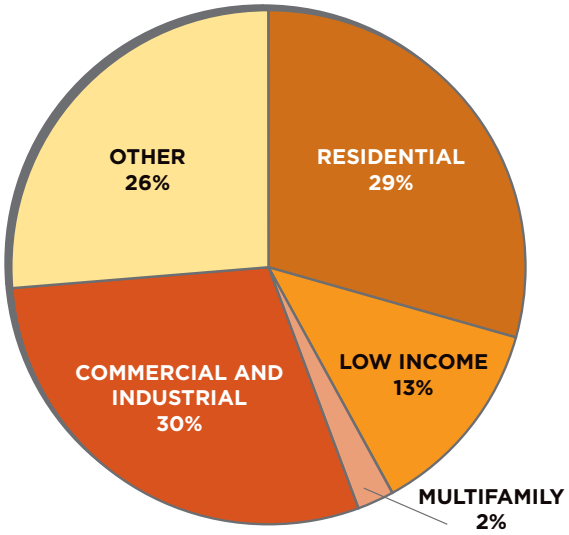



For ease of comparison between years, note that for 2013 onwards Figure 18 combines the commercial and industrial sectors into one "commercial and industrial" customer class as well as the residential and multifamily sectors into one "residential" customer class, as these categories weren't broken out 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 (30 percent), followed by residential (29 percent), and cross sector programs (26 percent). While this breakdown is consistent with recent trends, commercial and industrial as well as low income expenditures dropped considerably in 2015, resulting in residential and cross sector expenditures accounting for a relatively higher proportion of total expenditures. Analysis by CEE staff indicates that this change is primarily driven by the omission of the two large program administrators noted earlier, as both have historically reported robust commercial and industrial programs. 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.

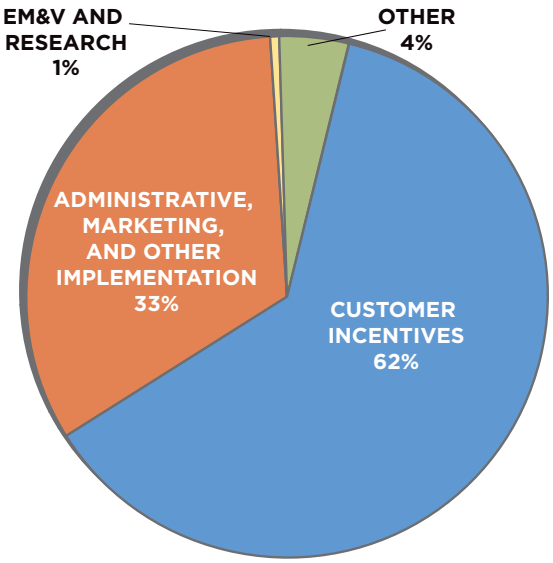
 

Figure 19 2015 Canadian Natural Gas Expenditures by Customer Class




Canadian gas expenditure data in Figure 20 below are broken out into slightly different cost categories than those used in the electric data sections of this report.[38]

Figure 20 2015 Canadian Natural Gas Expenditures by Category




The category breakdown of Canadian Natural Gas expenditures remained very similar from 2014 to 2015, with customer incentives representing roughly two-thirds of expenditures in 2015 (62 percent). A decrease in "other" category spending (four percent, down from 11 percent in 2014) led to a higher

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

proportion of 2015 spending allocated towards administrative, marketing, and other implementation (33 percent, up from 26 percent). The "other" category contains all funds program administrators could not separate into the more specific categories. Research, evaluation, measurement, and verification expenditures accounted for the remaining one percent of spending.

Canadian natural gas program administrators budgeted more than $121 million (approximately $162 million CAD) for programs in 2016, which represents an increase of 11 percent compared to 2015 budgets when adjusted for inflation. Considering just those program administrators who responded to the survey in both 2015 and 2016, programs spent 85 percent of the funds that were budgeted for natural gas programs in 2015.

# 4 Evaluation, Measurement and Verification

CEE, along with AGA, asked survey respondents to report spending on research and EM&V in 2015. Respondents to the electric survey were asked to provide the percentage of their total 2015 energy efficiency expenditures allocated to EM&V, whereas respondents to the gas survey were asked to provide the dollar amount.[39] Figures 21 and 22 below present the 2015 EM&V expenditures for electric and gas energy efficiency programs in the United States and Canada.[40]

**Figure 21 US and Canadian Electric EM&V Expenditures, 2015**

| COUNTRY | 2015 EM&V EXPENDITURES (MILLIONS USD) | TOTAL 2015 ENERGY EFFICIENCY EXPENDITURES (MILLIONS USD)* | EM&V % OF TOTAL EXPENDITURES |
|---|---|---|---|
| **UNITED STATES** | 124 | 5,318 | 2% |
| **CANADA** | 7 | 217 | 3% |
| **TOTAL** | 131 | 5,534 | 2% |

*This column includes estimates of EM&V.

[39] Like last year, electric EM&V expenditures in this report exclude demand response.

[40] 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 22 US and Canadian Natural Gas EM&V Expenditures, 2015**

| COUNTRY | 2015 EM&V EXPENDITURES (MILLIONS USD) | TOTAL 2015 ENERGY EFFICIENCY EXPENDITURES (MILLIONS USD) | EM&V % OF TOTAL EXPENDITURES |
|---|---|---|---|
| UNITED STATES | 26 | 1,312 | 2% |
| CANADA | 0* | 63 | 1% |
| TOTAL | 26 | 1,375 | 2% |

* While not visible in the table, Canadian natural gas EM&V expenditures reported for 2015 totaled over $358,000.

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, 70 percent of US and Canadian electric energy efficiency program administrators and 67 percent of US and Canadian gas program administrators indicated 2015 EM&V expenditures. EM&V expenditures comprised between one and three percent of 2015 energy efficiency expenditures in the United States and Canada, which is consistent with findings by other past research efforts.[41]

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.

41 "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, http://www1.eere.energy.gov/seeaction/pdfs/emv_ee_program_impact_guide.pdf, 7-14.

# 5 Estimated Program Savings and Environmental Impacts

CEE collected data on energy efficiency savings from gas and electric program administrators in 2015. 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 2015 from new 2015 participants in existing energy efficiency programs and from all participants in new 2015 programs.

CEE collected two different categories of savings values in the survey: net incremental savings and gross incremental savings.[42,43] 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 of 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.[44]

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

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

[43]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.

[44]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 publically 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 29,588 GWh in 2015 (see Figure 23). This is equivalent to nearly 20.8 million metric tons of avoided $CO_2$ emissions.[45] CEE member programs accounted for 79 percent of these estimated savings.

As noted in 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 below 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.

[45] Calculated using the EPA Greenhouse Gas Equivalencies Calculator, epa.gov/energy/greenhouse-gas-equivalencies-calculator. March 2017.

**Figure 23 US and Canadian Gross Incremental Electric Energy Efficiency Savings, 2015 (GWh): Ratepayer and All Sources Totals***

| | RESIDENTIAL | LOW INCOME | C&I | OTHER | NO BREAKOUT | RATEPAYER TOTAL | ALL SOURCES TOTAL |
|---|---|---|---|---|---|---|---|
| **UNITED STATES**** | | | | | | | |
| **NORTHEAST** | 2,155 | 188 | 3,442 | 103 | 296 | 5,669 | 6,184 |
| **MIDWEST** | 2,244 | 71 | 3,606 | 312 | 845 | 7,073 | 8,103 |
| **SOUTH** | 1,926 | 94 | 2,580 | 38 | 112 | 4,735 | 4,750 |
| **WEST** | 1,813 | 43 | 2,597 | 2,225 | 1,903 | 8,580 | 8,581 |
| **US SUBTOTAL** | 8,138 | 396 | 12,225 | 2,678 | 3,155 | 26,058 | 26,592 |
| **CANADA** | 404 | 12 | 1,053 | 703 | 826 | 2,997 | 2,997 |
| **BINATIONAL TOTAL** | 8,543 | 408 | 13,278 | 3,379 | 3,982 | 29,054 | 29,588 |

* Based on estimated total of all energy savings that accumulated from new participants in existing programs and all participants in new programs in 2015.

** One hundred (100) percent of electric survey respondents in the United States that reported EE programs reported a value for incremental energy savings. Of those that reported a value for incremental energy savings, eighty-five (85) percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

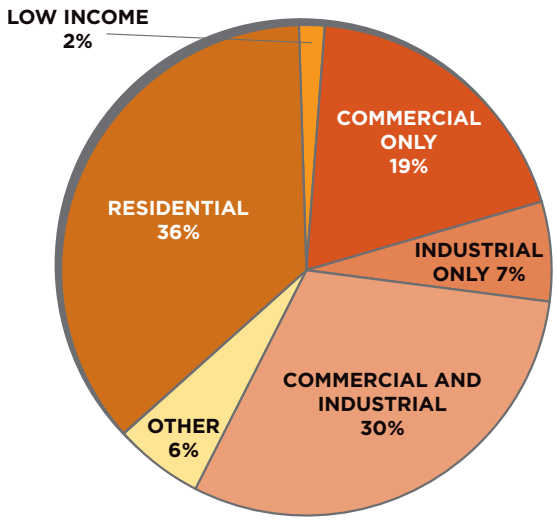
*** One hundred (100) percent of electric survey respondents in Canada that reported EE programs reported a value for incremental energy savings. Of those that reported a value for incremental energy savings, eighty (80) percent reported gross incremental savings. For respondents that did not report 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 just under one half of the total energy savings (46 percent), followed by residential (29 percent), other (24 percent), and low income (one 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 (36 percent) than of expenditures (27 percent). These findings are also consistent with last year's 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 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 2015 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 above, in 2015 the value of ratepayer-funded electric energy efficiency savings across the United States and Canada was over $3.0 billion.[46,47]

[46]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 2015 using data from the Energy Information Administration Electric Power Monthly December 2016 issue, which contains YTD 2015 data. Average electric rates used: $ 0.1265 per kWh (residential), $0.1064 (commercial), and $0.0691 (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 December 2016, accessed March 2017, eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_03.

[47]Canadian electric retail values were calculated based on the average rate per kWh across Canada in 2015 using data from an analysis maintained by Manitoba Hydro titled "Utility Rate Comparisons." Average electric rates used: $ 0.1556 CAD per kWh (residential), $0.1204 CAD per kWh (commercial) and $0.0714 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. "Utility Rate Comparisons," Manitoba Hydro, accessed March 2017, hydro.mb.ca/regulatory_affairs/energy_rates/electricity/utility_rate_comp.shtml#analysis.

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

**Figure 25 2015 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** | 278 | 36 | 417 | 70 | 60 | 766 | 860 |
| **MIDWEST** | 223 | 8 | 366 | 40 | 207 | 843 | 844 |
| **SOUTH** | 545 | 43 | 547 | 28 | 89 | 1,250 | 1,252 |
| **WEST** | 224 | 7 | 276 | 452 | 125 | 1,084 | 1,084 |
| **US SUBTOTAL** | 1,270 | 94 | 1,606 | 590 | 481 | 3,943 | 4,040 |
| **CANADA** | 72 | 5 | 216 | 101 | 119 | 514 | 514 |
| **BINATIONAL TOTAL** | 1,342 | 99 | 1,822 | 691 | 600 | 4,457 | 4,553 |

*Based on estimated total of all capacity savings that accumulated from new participants in existing programs and all participants in new programs in 2015.

**Eighty (80) percent of electric survey respondents in the United States that reported EE programs reported a value for incremental capacity savings. Of those that reported a value for incremental energy savings, eighty-four (84) percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

***Eighty (80) percent of respondents in Canada that reported EE programs reported a value for incremental capacity savings. Of those that reported a value for incremental savings, eighty (80) 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 forecasted 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 DR programs, the average savings per event, and each program's 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.[48] Respondents only reported ten "other peak" programs and seven "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 will 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 (average savings per event multiplied by the number of events) are abstract in that they denote the total capacity reduced in the course of an entire program year. As in 2015, in 2016 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 program-related capacity reductions, but we believe average MW reductions per event provide a much better indicator of program activity.

**Figure 26 US and Canadian Electric DR Total MW Savings by Program Target and Region**

| | SUMMER | WINTER | OTHER PEAK | NON-PEAK | MW SUBTOTALS |
|---|---|---|---|---|---|
| **UNITED STATES**** | | | | | |
| **NORTHEAST** | 29 | – | – | – | 29 |
| **MIDWEST** | 1,236 | – | 303 | 28 | 1,567 |
| **SOUTH** | 8,509 | 4,882 | 69 | 717 | 14,178 |
| **WEST** | 13,343 | – | 1,386 | 1,623 | 16,352 |
| **CANADA** | – | – | 34 | 2,792 | 2,826 |
| **BINATIONAL TOTAL** | 23,117 | 4,882 | 1,792 | 5,160 | 34,951 |

As shown in Figure 26, US and Canadian DR programs reduced capacity by 34,951 MW in 2015.[49] 47 percent of savings came from programs in the West, 41 percent from programs in the South, eight percent from programs in Canada, four percent from programs in the Midwest, and the remainder 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

[48] Note that program target is separate from program type (for example, direct load control); savings by program type are not analyzed here.

[49] 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 & Advanced Metering Staff Report," Federal Energy Regulatory Commission, ferc.gov/legal/staff-reports/2016/DR-AM-Report2016.pdf, 14.

within the wholesale markets. Only one respondent in the Northeast and two respondents in Canada reported DR savings this year.) Sixty-six percent of savings were achieved during summer peaks, 10 percent during winter peaks, four percent during other peaks, and 13 percent in relation to programs that did not target a peak.

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

| | SUMMER | WINTER | OTHER PEAK | NON PEAK | MW SUBTOTALS |
|---|---|---|---|---|---|
| **UNITED STATES** | | | | | |
| **NORTHEAST** | 29 | - | - | - | 29 |
| **MIDWEST** | 32 | - | 152 | 9 | 36 |
| **SOUTH** | 34 | 40 | 35 | 9 | 32 |
| **WEST** | 23 | 60 | 35 | 49 | 25 |
| **CANADA** | - | - | 34 | 279 | 257 |
| **BINATIONAL TOTAL** | 27 | 40 | 40 | 42 | 30 |

Figure 27 presents average MW savings by region and target. Demand response programs in the United States and Canada saved on average 30 MW per event in 2015.[50] In the United States, the Midwest saved the most on average per event (36 MW). Winter peak programs and "other peak" programs both saved 40 MW, with "non-peak" saving slightly more (42 MW), and summer achieving less (27 MW), on average per event. Canadian savings per event were boosted in 2016 by a response from a single program administrator that reported high savings per "non-peak" event, though due to their low number of events reported overall this has only a slight effect on the total average savings per event across the United States and Canada.

## 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 496 million therms of gas in 2015. This is equivalent to over 2.6 million metric

[50] To get a sense of magnitude for average US and Canadian DR capacity savings, 30 MW represents roughly a quarter 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 2015 EIA Form 860, Schedule 3 data, the "total" DR savings of 34,951 MW is roughly equivalent to the combined net summertime capacity of the 70 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 2017, eia.gov/electricity/data/eia860/.

tons of avoided $CO_2$ emissions.[51] CEE member programs accounted for 96 percent of the total energy savings estimate.

**Figure 28 2015 US and Canadian Incremental Natural Gas Savings (MDth)**

| | RESIDENTIAL | LOW INCOME | MULTI-FAMILY | C&I | OTHER | NO BREAKOUT | RATEPAYER TOTAL |
|---|---|---|---|---|---|---|---|
| **UNITED STATES**** | | | | | | | |
| **NORTHEAST** | 3,710 | 1,093 | 486 | 3,449 | 171 | 0 | 8,900 |
| **MIDWEST** | 6,770 | 601 | 616 | 10,665 | 187 | 0 | 18,839 |
| **SOUTH** | 803 | 47 | 2 | 446 | 0 | 0 | 1,298 |
| **WEST** | 2,712 | 468 | 217 | 3,614 | 2,476 | 0 | 9,487 |
| **US SUBTOTAL** | 13,986 | 2,209 | 1,321 | 18,174 | 2,834 | 0 | 38,524 |
| **CANADA** | 421 | 226 | 264 | 2,223 | 7,982 | 0 | 11,116 |
| **BINATIONAL TOTAL** | 14,407 | 2,435 | 1,585 | 20,397 | 10,816 | 0 | 49,640 |

*Based on estimated total of all energy savings that accumulated from new participants in existing programs and all participants in new programs in 2015.

**Eighty-three (83) 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, eighty-eight (88) percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

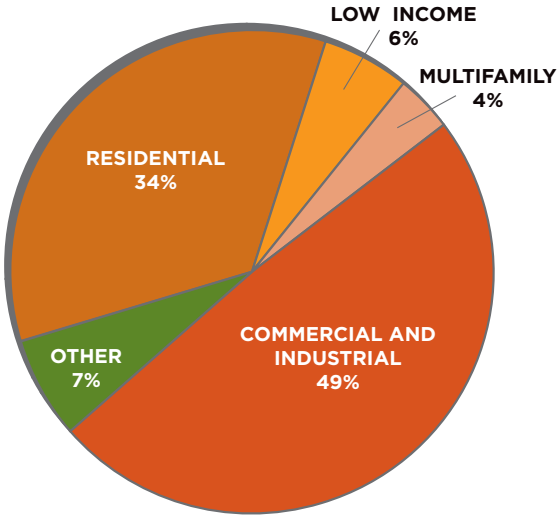
**One hundred (100) percent of all gas respondents in Canada that reported gas programs reported a value for incremental savings. Of those that reported a value for incremental savings, eighty-three (83) percent reported gross incremental savings.

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 (50 percent), followed by residential programs (34 percent). Low income programs came in at six percent while multifamily programs represented three percent. "Other" programs accounted for seven percent of the estimated natural gas energy savings and include programs not allocable by customer class. This breakdown is somewhat different from that of US and Canadian gas energy efficiency expenditures, in which residential programs accounted for 37 percent of expenditures, low income programs accounted for 26 percent, and C&I programs accounted for 21 percent. This may indicate high savings per dollar spent in the C&I sector, but it may also reflect a difference in reported savings

[51] Calculated using the EPA Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator. March 2017.

type—gross or net—between program administrators with high residential and high C&I expenditures.[52]

Figure 29 2015 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 2015 the value of natural gas energy efficiency savings across the United States and Canada totaled approximately $387 million.[53]

[52] See the opening paragraphs of Section 1 for more information on the savings accounting scheme used in this report.

[53] 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 2015 using data from the Energy Information Administration. Average natural gas prices used: $10.38 per Mcf (residential), $7.91 per Mcf (commercial), and $3.91 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, 2017, accessed March 3, 2017, 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 | 2015 EXPENDITURES |
|---|---|---|
| RESIDENTIAL | OTHER | $561,364,446.52 |
| COMMERCIAL AND INDUSTRIAL | MIXED OFFERINGS | $530,446,648.32 |
| COMMERCIAL | OTHER | $425,901,536.41 |
| LOW INCOME | LOW INCOME | $353,239,376.02 |
| COMMERCIAL | GOVERNMENT, NONPROFIT, MUSH | $300,604,904.29 |
| COMMERCIAL AND INDUSTRIAL | PRESCRIPTIVE | $273,573,524.08 |
| RESIDENTIAL | CONSUMER PRODUCT REBATE—LIGHTING | $248,405,634.97 |
| COMMERCIAL AND INDUSTRIAL | CUSTOM | $217,811,875.52 |
| COMMERCIAL | SMALL COMMERCIAL—PRESCRIPTIVE | $147,568,595.72 |
| RESIDENTIAL | WHOLE HOME - RETROFIT | $139,518,305.64 |
| CROSS SECTOR | OTHER | $135,131,620.93 |
| COMMERCIAL AND INDUSTRIAL | OTHER | $134,075,246.96 |
| RESIDENTIAL | PRESCRIPTIVE - HVAC | $131,161,902.26 |
| RESIDENTIAL | WHOLE HOME - AUDITS | $130,401,504.26 |
| COMMERCIAL AND INDUSTRIAL | NEW CONSTRUCTION | $124,713,891.96 |
| INDUSTRIAL | CUSTOM - INDUSTRIAL OR AGRICULTURAL PROCESSES | $115,280,631.07 |
| COMMERCIAL | CUSTOM—OTHER | $103,830,890.00 |
| RESIDENTIAL | CONSUMER PRODUCT REBATE - APPLIANCES | $100,135,600.32 |
| INDUSTRIAL | OTHER | $93,712,271.67 |
| RESIDENTIAL | BEHAVIORAL, ONLINE AUDIT, FEEDBACK | $72,121,021.77 |
| CROSS SECTOR | MARKETING, EDUCATION, OUTREACH | $63,254,266.05 |
| RESIDENTIAL | NEW CONSTRUCTION | $62,410,497.14 |
| COMMERCIAL | PRESCRIPTIVE—LIGHTING | $60,985,946.96 |
| RESIDENTIAL | WHOLE HOME—DIRECT INSTALL | $59,785,799.60 |
| COMMERCIAL | PRESCRIPTIVE—OTHER | $58,148,250.20 |
| COMMERCIAL | PRESCRIPTIVE—HVAC | $55,812,005.13 |
| RESIDENTIAL | APPLIANCE RECYCLING | $53,844,137.80 |
| RESIDENTIAL | PRESCRIPTIVE—OTHER | $50,669,681.49 |
| CROSS SECTOR | PLANNING, EVALUATION, OTHER PROGRAM SUPPORT | $50,218,125.24 |
| CROSS SECTOR | MULTI-SECTOR REBATES | $45,720,423.32 |
| COMMERCIAL | NEW CONSTRUCTION | $43,279,646.00 |
| RESIDENTIAL | MULTIFAMILY | $31,185,969.75 |

| | | |
|---|---|---|
| CROSS SECTOR | MARKET TRANSFORMATION | $28,515,424.78 |
| RESIDENTIAL | FINANCING | $26,963,125.00 |
| CROSS SECTOR | CODES & STANDARDS | $26,508,709.22 |
| COMMERCIAL | CUSTOM - AUDIT | $20,427,462.00 |
| COMMERCIAL | CUSTOM - RETROCOMMISSIONING | $19,356,595.85 |
| COMMERCIAL | SMALL COMMERCIAL - CUSTOM | $18,643,084.33 |
| CROSS SECTOR | RESEARCH | $13,123,194.81 |
| COMMERCIAL AND INDUSTRIAL | AUDIT | $9,743,568.53 |
| RESIDENTIAL | CONSUMER PRODUCT REBATE - ELECTRONICS | $9,439,226.00 |
| INDUSTRIAL | CUSTOM - OTHER | $9,067,816.99 |
| CROSS SECTOR | VOLTAGE REDUCTION, TRANSFORMERS | $8,246,865.00 |
| COMMERCIAL | PRESCRIPTIVE - IT & OFFICE EQUIPMENT | $6,782,831.76 |
| COMMERCIAL | STREET LIGHTING | $6,782,831.76 |
| CROSS SECTOR | WORKFORCE DEVELOPMENT | $6,641,425.00 |
| RESIDENTIAL | PRESCRIPTIVE - INSULATION | $6,423,451.71 |
| INDUSTRIAL | PRESCRIPTIVE - AGRICULTURE | $5,749,376.52 |
| INDUSTRIAL | NEW CONSTRUCTION | $3,871,191.72 |
| INDUSTRIAL | CUSTOM - AUDIT | $3,346,662.44 |
| COMMERCIAL | PRESCRIPTIVE - GROCERY | $3,174,818.78 |
| RESIDENTIAL | PRESCRIPTIVE - POOL PUMP | $2,904,859.00 |
| INDUSTRIAL | PRESCRIPTIVE - MOTORS | $2,596,071.06 |
| COMMERCIAL AND INDUSTRIAL | SELF DIRECT | $2,482,276.10 |
| INDUSTRIAL | PRESCRIPTIVE - OTHER | $2,034,714.00 |
| CROSS SECTOR | SHADING, COOL ROOFS | $947,387.92 |
| RESIDENTIAL | PRESCRIPTIVE - WATER HEATER | $892,831.00 |
| COMMERCIAL | FINANCING | $827,220.00 |
| INDUSTRIAL | CUSTOM - DATA CENTERS | $684,368.93 |
| INDUSTRIAL | CUSTOM - REFRIGERATED WAREHOUSES | $191,856.97 |
| RESIDENTIAL | PRESCRIPTIVE - WINDOWS | $45,000.00 |
| INDUSTRIAL | SELF DIRECT | $3,505.73 |

**Figure B-1 Canadian Electric Energy Efficiency Program Category Expenditures (in USD and CAD)**

| CUSTOMER CLASS | PROGRAM TYPE | 2015 EXPENDITURES USD | 2015 EXPENDITURES CAD |
|---|---|---|---|
| INDUSTRIAL | PRESCRIPTIVE - OTHER | $51,706,684.73 | $66,258,548.72 |
| INDUSTRIAL | OTHER | $26,665,970.55 | $34,170,601.31 |
| COMMERCIAL | PRESCRIPTIVE - OTHER | $25,319,282.71 | $32,444,913.76 |
| COMMERCIAL | STREET LIGHTING | $17,577,817.93 | $22,524,760.81 |
| COMMERCIAL | OTHER | $15,710,479.12 | $20,131,894.97 |
| COMMERCIAL | NEW CONSTRUCTION | $11,652,210.64 | $14,931,503.94 |

| | | | |
|---|---|---|---|
| RESIDENTIAL | CONSUMER PRODUCT REBATE - LIGHTING | $9,686,773.34 | $12,412,931.64 |
| COMMERCIAL | PRESCRIPTIVE - LIGHTING | $9,143,431.45 | $11,716,676.51 |
| CROSS SECTOR | MARKETING, EDUCATION, OUTREACH | $8,533,582.90 | $10,935,197.67 |
| LOW INCOME | LOW INCOME | $8,414,618.36 | $10,782,752.82 |
| RESIDENTIAL | PRESCRIPTIVE - OTHER | $6,714,586.38 | $8,604,279.14 |
| CROSS SECTOR | RESEARCH | $6,473,450.36 | $8,295,279.96 |
| RESIDENTIAL | OTHER | $5,968,754.52 | $7,648,547.08 |
| RESIDENTIAL | APPLIANCE RECYCLING | $4,756,259.64 | $6,094,818.55 |
| RESIDENTIAL | CONSUMER PRODUCT REBATE - APPLIANCES | $4,037,688.43 | $5,174,019.12 |
| COMMERCIAL AND INDUSTRIAL | CUSTOM | $3,910,244.10 | $5,010,708.00 |
| RESIDENTIAL | WHOLE HOME - RETROFIT | $3,837,462.18 | $4,917,443.00 |
| RESIDENTIAL | PRESCRIPTIVE - HVAC | $3,814,174.74 | $4,887,601.75 |
| CROSS SECTOR | CODES & STANDARDS | $3,803,152.08 | $4,873,476.98 |
| RESIDENTIAL | WHOLE HOME - DIRECT INSTALL | $3,775,392.10 | $4,837,904.48 |
| RESIDENTIAL | BEHAVIORAL, ONLINE AUDIT, FEEDBACK | $3,433,092.70 | $4,399,271.41 |
| COMMERCIAL | SMALL COMMERCIAL - PRESCRIPTIVE | $3,381,592.79 | $4,333,277.83 |
| CROSS SECTOR | OTHER | $2,147,455.06 | $2,751,815.49 |
| RESIDENTIAL | NEW CONSTRUCTION | $2,107,260.02 | $2,700,308.31 |
| INDUSTRIAL | CUSTOM - INDUSTRIAL OR AGRICULTURAL PROCESSES | $1,801,270.74 | $2,308,204.16 |
| CROSS SECTOR | VOLTAGE REDUCTION, TRANSFORMERS | $1,618,362.59 | $2,073,819.99 |
| COMMERCIAL | CUSTOM - AUDIT | $933,795.21 | $1,196,594.13 |
| COMMERCIAL | SMALL COMMERCIAL - CUSTOM | $872,627.55 | $1,118,212.00 |
| RESIDENTIAL | MULTIFAMILY | $865,181.84 | $1,108,670.83 |
| RESIDENTIAL | PRESCRIPTIVE - INSULATION | $760,420.84 | $974,426.84 |
| COMMERCIAL | CUSTOM - RETROCOMMISSIONING | $439,423.47 | $563,090.86 |
| CROSS SECTOR | PLANNING, EVALUATION, OTHER PROGRAM SUPPORT | $280,181.45 | $359,033.20 |
| RESIDENTIAL | WHOLE HOME - AUDITS | $89,645.15 | $114,874.07 |
| COMMERCIAL | GOVERNMENT, NONPROFIT, MUSH | $36,598.46 | $46,898.40 |
| RESIDENTIAL | FINANCING | $33,985.61 | $43,550.22 |
| COMMERCIAL | PRESCRIPTIVE - HVAC | $32,367.25 | $41,476.40 |

# 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

Over three-quarters of 2015 demand response program expenditures went to incentive-based programs, as shown in Figure C-1. Of those expenditures, two-fifths, 43 percent, went to direct load control programs, followed by interruptible load at 31 percent, emergency demand response at 13 percent, other incentive-based programs at 10 percent, load as a capacity resource at two percent, and demand bidding and buyback at one percent (see Figure C-2). While the incentive-based program breakdown is similar to 2013 and 2014, in 2015 direct load control programs surpassed interruptible load programs as the most invested-in incentive-based demand response program type, increasing from 36 to 43 percent of total incentive-based demand response expenditures as interruptible load programs decreased from 40 to 31 percent of reported expenditures.

Two percent of demand response expenditures went to time-based programs, and all of the time-based programs reported were further categorized as peak time rebate programs. In the 2015 survey critical peak pricing programs were also reported, however this spending was primarily driven by a single program administrator that indicated only peak time rebate spending in 2016. While not empirically supported in the program level expenditure data for time-based demand response programs shown here, CEE staff hypothesize that overall declines in US and Canadian demand response expenditures could be indicative of a broader shift in approach towards less costly time-based rate programs, which may reduce program costs by encouraging demand reduction using graduated pricing schemes rather than direct customer incentives.

Figure C-1 2015 US Electric Demand Response Expenditures: General Categorization

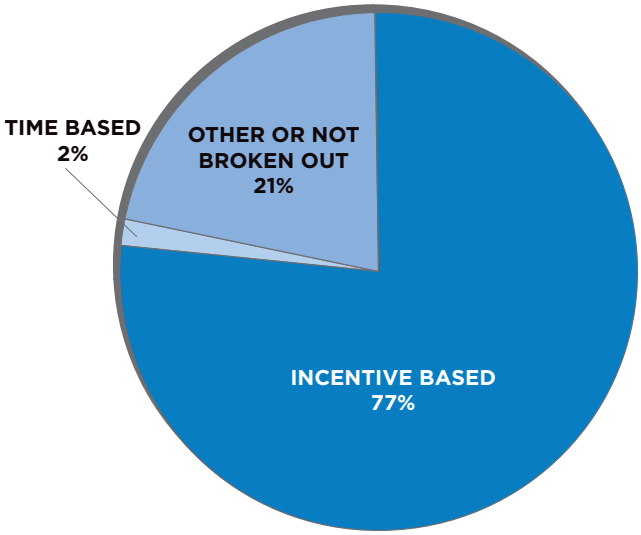
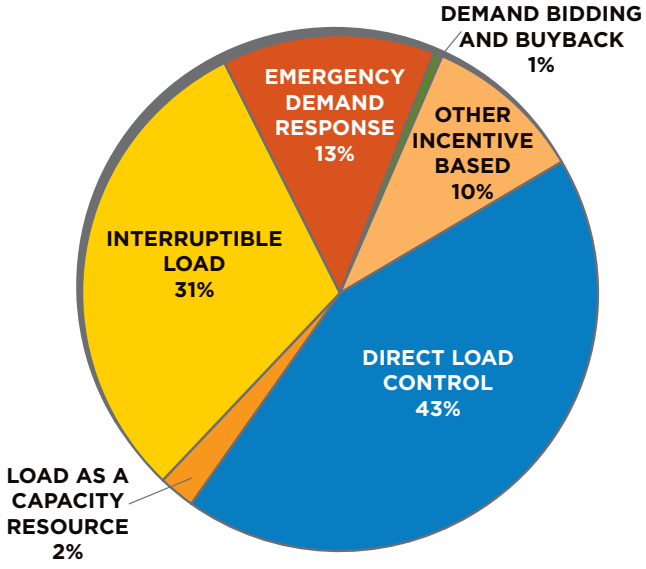



Figure C-2 2015 US Electric Demand Response Expenditures: Incentive-Based Programs



## Canadian Electric Demand Response Program Category Expenditures

In 2014, thanks to the submission from a large Canadian program administrator CEE was able to provide a rough breakdown of demand response program expenditures into the high level FERC categories. However, as this program administrator did not respond in 2015 or 2016, such an analysis is not possible in this release. CEE will provide such a breakdown in future reports if the data afford the opportunity.

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