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Analysis of Energy Efficiency Program Impacts Based on Program Spending

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Analysis of Energy Efficiency Program Impacts Based on Program Spending

The growth of energy efficiency (EE) programs at utility and state levels affects energy consumption in sectors targeted by such programs. Program spending effects are not uniform in terms of timing, investment trends, affected end uses, customer types and context (specific historical, market, policy and other relevant factors). Improved understanding of the effects of EE programs can improve baseline energy demand projections and enable enriched policy and scenario analysis related to programs that encourage or mandate increased EE program activity.

To gain insight into recent EE program activity and related implications for energy consumption, EIA contracted with Leidos Engineering, LLC (Leidos), previously known as Science Applications International Corporation (SAIC) to conduct research on regional differences in energy efficiency programs and spending. The contracted research report is included as Appendix A. The scope of the project was to characterize EE spending related to residential and commercial energy use for each of the nine Census divisions (see map)—the level of geographic detail used by the Residential Demand Module and Commercial Demand Module of the National Energy Modeling System (NEMS). Leidos research focused on rebate programs used by utilities as incentives for customers to purchase higher-efficiency products.

The report submitted by Leidos characterizes EE program spending at the end-use level. This information will be used by EIA as an input to the development of modeling assumptions for projections related to incremental EE programs in NEMS. Specifically, these inputs will be used to develop program spending allocations ('model portfolios') at the regional level in the NEMS building modules for lighting, heating, air conditioning, water heating, ventilation, refrigeration, and other end uses. The results, including regional variation in spending and efficiency gains, will support EIA's updates of the analytical and modeling assumptions in NEMS.

In selecting representative utilities for analysis, Leidos sorted utilities into five program categories across all Census divisions, based on their 2012 reporting of EE programs and spending on EIA Form EIA-861, *Annual Electric Power Industry Report*, which collects information on the status of electric power industry participants involved in the generation, transmission, distribution, and sale of electric energy in the United States, its territories, and Puerto Rico. In addition to three categories based on program spending levels (high, medium, and low) there was a per customer category for residential programs, and a per megawatt-hour category for commercial programs.¹

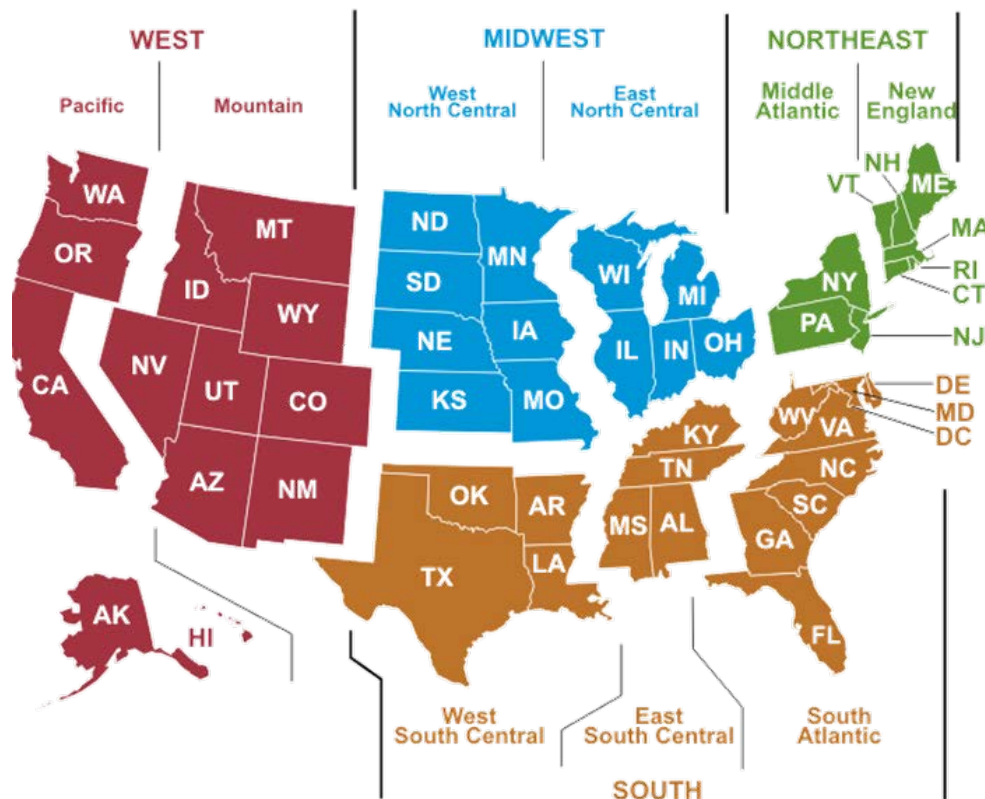
Leidos examined EE program reports filed with state public utility commissions by selected utilities to characterize spending by end-use. In many instances programs can be divided into two groups based on their end-use emphasis: programs that are narrowly focused on lighting and heating, ventilation and air conditioning (HVAC) or broader programs that direct efficiency funds and services to a wider range of end-uses, technologies, and customers. The more investment a given state or provider makes in energy efficiency, the more likely they are to design and implement a broader program. In part this is because

¹ Two additional categories relate to the way data are reported by certain entities that provide electric service and/or efficiency program services. If an entity reported EE program spending but no electricity sales, Leidos put them in a "no sales" category; if they reported electricity sales but no program spending, they were put in a "no spend" category.

the initial end use areas, although cost-effective, become saturated and this requires a broader effort if further energy savings are to be achieved.

In addition to supporting EIA's own efforts to enhance NEMS, the information in the Leidos report, including regional variation in spending and efficiency gains, will complement other research that seeks to provide greater public information and analysis about EE program spending and efficiency outcomes. This is important given the growing use of energy efficiency programs, with close to 30 states already having adopted EE goals, pilots, or demand reduction targets.² EE programs are also a potential strategy available to states under EPA's proposed Clean Power Plan rule under Section 111(d) of the Clean Air Act.

Figure 1. Map of U.S. Census Regions and Divisions³



Source: U.S. Energy Information Administration

² Analysis by U.S. Energy Information Administration using data in: American Council for an Energy Efficient Economy (ACEEE), [State Energy Efficiency Resources Standards \(EERS\)](#) (April 2015), accessed May 15, 2015; ACEEE, [State and Local Policy Database](#), accessed May 15, 2015; [Database of State Incentives for Renewables and Efficiency](#) (DSIRE); and state public utility commission (PUC) websites.

³ The Leidos report in Appendix A also refers to the Census divisions by number in the following order: 1. New England, 2. Middle Atlantic, 3. East North Central, 4. West North Central, 5. South Atlantic, 6. East South Central, 7. West South Central, 8. Mountain, 9. Pacific.

When referencing the contract report in Appendix A, it should be cited as a report by Leidos Engineering, LLC prepared for the U.S. Energy Information Administration.

APPENDIX A

Task Number DE-DT0007965 Subtask 13

Analysis of Energy Efficiency Program Impacts on Energy Consumption Based on Program
Spending

Final Report

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To the
U.S. Energy Information Administration

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Introduction to Scope of Work

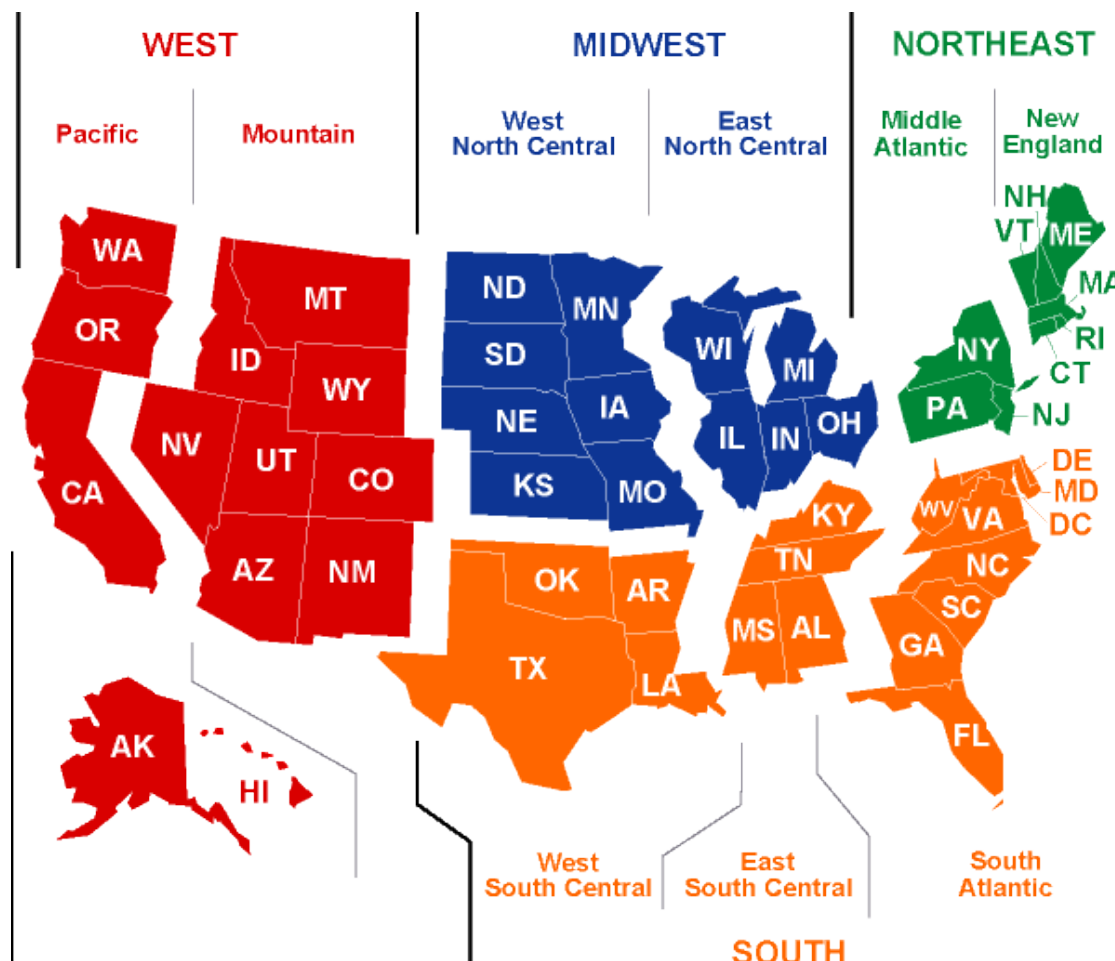
This report summarizes an approach to quantifying aspects of state-sponsored energy efficiency (EE) programs and demand side management (DSM) spending in the United States, to assist in developing analytic assumptions and model inputs used by the U.S. Energy Information Administration (EIA) to project reductions in building energy consumption due to EE program activities. The work activity is aimed at continuous quality improvement in EIA's modeling programs, to maintain relevancy and consistency with changing energy markets. The project scope includes collection and analysis of data to characterize program impacts on end-use energy consumption in the residential and commercial building sectors.

The results of the project are to be utilized as inputs to the residential and commercial sector demand modules in EIA's National Energy Modeling System (NEMS), to account for the regional impacts of EE initiatives on equipment characteristics and energy consumption in the US, at the level of Census divisions (CD), shown in Figure 1 (U.S. Energy Information Administration, 2014).

Other regional and U.S. initiatives have attempted or are attempting to characterize energy efficiency program spending at various levels. Lawrence Berkeley National Laboratory is compiling program administrators' savings and cost data from 31 states in 4 Census regions for their Cost of Saved Energy project (Billingsley, Hoffman, Stuart, Schiller, Goldman, & LaCommare, 2014). The Northeast Energy Efficiency Partnerships started collecting and reporting efficiency program spending and savings data from eight states and the District of Columbia in 2013 via the Regional Energy Efficiency Database (REED) (Northeast Energy Efficiency Partnerships, 2014). A 2011 report summarized electric energy efficiency spending and savings by utility for a sample of 50 utilities, representing two-thirds of total U.S. electric program funding as of 2009 (Jones, Hoffman-Andrews, Liberman, Reynolds, & Whitman, 2011). Leidos relied on similar data sources to derive spending estimates per program year at the regional U.S. level, given programs offered in the 2009-2013 timeframe, and covering both electric and non-electric energy initiatives where available.

The report presents Leidos' approach and methods for characterizing the impact of program spending on end-use energy consumption in the residential and commercial building sectors, and analysis of EE program spending data, by Census division.

Figure 1. Map of U.S. Census Regions and Divisions



Source: U.S. EIA, Commercial Buildings Energy Consumption Survey (CBECS) website:
<http://www.eia.gov/consumption/commercial/census-maps.cfm>

Characterizing Impacts of Program Spending on End-Use Consumption

Assumptions

The following assumptions guide the approach to estimating the impact of EE program proposed or actual spending on building end-use energy consumption:

- The level of spending on energy efficiency programs in a Census division is primarily a function of utility revenue (sales) and ratepayer charges collected to fund these programs.
- Spending on incentives and services that promote energy efficient equipment and activities in the buildings sector varies by region.
- Utility budgets and expenditures for efficiency and demand side management programs can be allocated to specific building end-uses.

Sources of funding: While many regulated electric and gas utilities have tariff mechanisms (such as system benefit charges) to collect funds from ratepayers to cover the costs of EE program implementation, these charges are not the only funding source used to support EE initiatives available to residents of a state or region. State budget allocations, American Recovery and Reinvestment Act

(ARRA) funding, revolving loan fund initiatives, regional capacity market auctions, or fees collected from certain industries may supplement or wholly fund programs administered either by a utility or a third party. For example, the Vermont Energy Investment Corporation has funded EE programs by ratepayer fees for electric initiatives, and by Vermont's Regional Greenhouse Gas Initiative revenues for fossil and other fuel consumption-based initiatives (Vermont Energy Investment Corporation, 2012), plus netted about 10% of their annual program spending in the ISO-New England capacity market in 2012 (Neme & Cowart, 2014).

Regulated utilities are likely to separate their customer and outside sources of income in plans and reports, but publicly-available EE budget and expenditure data may omit other market influences. These can include co-funding paid by program partners, or federal, regional, local, or non-profit education and promotion initiatives that have no direct disbursement of funds to that reporting entity.

Regional variability: EE budgets and expenditures on direct-to-customer subsidies for energy-saving projects and equipment are often set to cover a fixed portion of the customer's cost, to ensure fair and cost-effective program delivery to the participants. Those project costs themselves vary based on geography, market availability, and competition among vendors and contractors, while utility rates and sales demographics variation also contribute to the impact of energy conservation programs in a region. Neighboring states' EE activities can also have cross-influences on each other's offerings and expenditures. Some utilities operate similar EE programs across Census division boundaries, such as National Grid in CD 1 and 2, and Tennessee Valley Authority in CD 5 and 6. Capturing regional variability (where regions are defined by Census divisions) was a main objective of this research, but regional variability was initially expected to be less apparent in adjacent Census divisions for these reasons, data availability notwithstanding. Program data availability in the form of utility reports or plans may be a factor of geography also, because states apply different program reporting and documentation rules. Lack of available data influences the apparent regional variability of program spending in this study.

End-use allocations: Some regulated utilities plan and track spending at the level of end-uses or measures, to watch market penetration and be able to shift spending and program requirements according to market needs. For example, Sacramento Municipal Utility District reported expenditures and savings achieved at end-use level in an annual report on the California public sector programs (California Municipal Utilities Association, 2014). Annual reports required by the public commission don't always require a measure level of detail, however, and utilities may not consider that data as public information. Evaluation, measurement and verification (EM&V) activities may include verifying claimed savings attributed to end-uses or to measure types. While savings allocations may not translate to equivalent spending allocations, savings allocations by end-use are more prevalent in utility reports and plans, and are used as proxies for budget or spending allocations for the purposes of this analysis.

Utilities also vary in how they define their budgets and spending. Some differentiate funds for customer incentives vs. third party implementation vs. internal administration vs. marketing; others roll those various program activities into a single program budget. These differences are likely due to state reporting and funding allocation rules. If a utility presents a program budget with no distinction for how it is to be spent, this study assumes that the budget can be entirely allocated to building end-use energy savings via default allocation assumptions. However, it is noted that less than 100% of a utility program budget is spent to directly subsidize end-use equipment purchases or changes in end-use consumption.

Approach

The scope of this work is focused on characterizing EE program spending on building end-use consumption, for example estimating energy consumption in residential building lighting. This approach does not differentiate between different equipment technologies that can be employed to

serve a given end-use, such as incandescent, compact fluorescent, or light-emitting diode (LED) bulbs and fixtures in residential lighting. Later work may seek to allocate regional EE program spending to specific technologies, but technology-specific allocations are not applied here.

Leidos performed the following steps for characterizing regional EE program spending by end-use; details on the approach are provided later in this report:

1. Combined available utility sales data and reported EE spending data obtained from the 2012 EIA-861¹ to develop a basis for ranking electric utility spending by residential and commercial sector within Census Divisions. No equivalent EE program spending database for gas and fuel providers was found, although EIA publishes company sales data by state (U.S. Energy Information Administration, 2013).
2. Normalized and ranked utility EE spending and electric sales reported on the 2012 Form EIA-861 for the commercial and residential sectors, in each CD.
3. Defined a sample of utilities to represent the typical or most prevalent EE programs in each CD and collect filed plans, commission reports, and/or EM&V reports that provide detail on proposed and actual EE spending and savings. The sample was further categorized by level of program spending per unit of sales.
4. Defined energy efficiency programs offered for the two sectors according to the collected documentation, and determined program spending on each program—for example, utility X offers Low Income, Retail Lighting, Home Performance with ENERGY STAR, ENERGY STAR Appliances for residential customers. Recorded rebate and total spending and savings that each of these programs offers, to make up 100% of the EE spending in the portfolio for that program cycle or program year. Where possible, programs exclusively supporting renewable generation or demand response were excluded as out of scope.
5. For each program defined in step 4, estimated the percent of program spending (incentive only and total) allocated to each end-use, where end-uses are defined as Lighting, Heating, Cooling, Water Heating, Appliances, and Other. This estimation method is discussed further in the data analysis section.
6. The utility's program spend from step 4, multiplied by the end-use percent spend from step 5, is the end-use program spending for that utility in that program cycle or reporting period.
7. Determined end-use spending per year for each end-use, spending category, sector and Census division. The annualized spending on a reported utility program is calculated given the known program cycle, and then the program annual spending is summed for that Census division and spending category. Annualized spending was then normalized to 2014 dollars using the GDP Chain-Type Price Indices referenced in EIA's Annual Energy Outlook for 2012 and 2014, Reference Case (U.S. Energy Information Administration, 2012 & 2014).

¹ <http://www.eia.gov/electricity/data.cfm>

Utility Sampling Methodology

Approach

Leidos compared U.S. utilities' 2012 data using Form EIA-861² for retail electricity sales and energy efficiency programs. Where data fields were filled with "." rather than values, those entries were replaced with blank cells. Leidos ranked utilities according to the criteria listed in Table 1, in each of nine Census divisions defined in the original scope of work, and for each customer sector.

Table 1. Initial Utility Ranking Strategies

Sector	Sales Metric	Program Spending Metric
Commercial	MWh sales	Total program \$ per MWh sold
Residential	MWh sales	Total program \$ per customer

A limited set of third party EE program administrators submit Form EIA-861 as required by EIA. The 2012 EE program data in Form EIA-861 were found to include respondents who reported program spending but no retail sales (resulting in infinite values for the program metrics), as well as respondents reporting electricity sales but no spending (resulting in 0 value program metrics). Some of the 'no sales' entities reporting program spending (such as Vermont Energy Investment Corporation, or the New York Energy Research and Development Authority (NYSERDA) are likely implementing programs on behalf of or supplementing co-located utility respondents (such as the Central Vermont Public Service Corporation and New York utilities).

A summary of reported Form EIA-861 utility data from 2012 is shown below in Table 2.

Table 2. Populations of EIA-861 Reporting Utilities for 2012

Census Division	Count of Utilities Reporting Sales (MWh sold)	Count of Utilities Reporting EE Incentives, Residential Sector	Count of Utilities Reporting EE Incentives, Commercial Sector
1	36	22	20
2	34	21	18
3	152	55	48
4	199	121	103
5	128	64	42
6	27	14	12
7	63	26	21
8	77	48	37
9	73	56	52
Total	789	427	353

² Form EIA-861, *Annual Electric Power Industry Report*, at <http://www.eia.gov/electricity/data/eia861/>

Utilities were somewhat informally categorized within each sector and CD³, into five ranked tiers by EE program spending levels for further analysis: having relatively high, medium, or low program spending metric values among the sorted utility population, as defined in Table 1; or being in a ‘no spend’ or ‘no sales’ category⁴. Utilities contributing the top 50%⁵ of electricity sales in each census division were compared to the utilities appearing in these categorized lists. Where those two lists converged, those utilities were selected for data collection. The resulting sample represented variations in normalized program spending within a region as well as across regions, and also ensured that the sampled programs coincided with the utilities contributing the majority of customer energy demand. The goal was to include at least two utilities in every program spending category, for each sector and CD. The final sample is provided in Appendix 1.

Sample strategy limitations and clarifications

Top Sales Threshold Definition

The top retail sales threshold was initially limited up to 50% because beyond that threshold, adding an individual utility resulted in marginal added sales. However, some Census divisions lacked sufficient numbers of utilities reporting non-zero EE program spending, to assign two utilities to every spending category. In CD 5 and 7 through 9, the top retail sales threshold was extended up to 75% to expand the utility sample. In CD 4 and 6, the limited number of investor-owned utilities reporting EE program spending (and likely to be submitting regular program documentation to state commissions) prohibited the selection of two utilities for every category. However, inherent commonalities often arise in program offerings among regionally co-located utilities, and Leidos would contend that these commonalities may be adequately represented by a single utility per category.

Non-electric program coverage

Form EIA-861 does not collect sales or EE program spending data for natural gas or other building energy fuel providers. Some sampled electric utilities also administer or co-administer EE funding for natural gas or other fuel conservation initiatives. Where those non-electric programs are noted in comprehensive planning, reporting, or evaluation documents found for the defined utility sample, Leidos included that information in the analysis. Several of these sampled utilities appear in the American Gas Association’s 2012 Top 50 residential and commercial gas market lists⁶, as noted in

³ No quantitative, common threshold was set for these rankings, because what constituted ‘high’ EE spending per unit sales in one Census division could be nearly an order of magnitude different from the highest spending per unit sales utility in another Census division.

⁴ ‘No spend’ refers to utilities reporting zero program spending or not appearing in the Form EIA-861 EE program database; ‘No sales’ refers to utilities reporting zero retail sales or not appearing in the Form EIA-861 retail sales database.

⁵ As described further below, this threshold was extended for some Census divisions to 75% to create a larger sample.

⁶ See revenue and volume rankings provided at <http://www.aga.org/utility-rankings>

Appendix A1.

Efficiency Program Spending Data Collection

Data fields

The types of data to be collected were established based on typical contents of EE program documentation available, and on data needed to complete the task. The collected data are defined in Table 3.

Table 3. Collected EE Data

Field Name	Description
Census Region	Numeric Census division
Ranking Lookup	Normalized Program Spending Ranking: High, Medium, Low, No Sales, No Spend
Utility	Name or names of the utility sampled
Program (Name)	How the utility refers to a program element
Subsector Lookup	Within the defined Residential or Commercial sector, segments of that target customer sector may be grouped together for budget or goal purposes, such as Single Family Residential vs. Multi-Family Residential. However, some reported programs do not differentiate by customer sector.
Proposal Document Type Lookup	Type of PROPOSED document (e.g. by the utility to the commission) in which data were found. These are often comprised of filed plans, Commission Orders, or sections of Integrated Resource Plans.
Plan Start Year	Year 1 of the proposed program plan for which data were found
Plan Years Covered LOOKUP	Number of years duration of the program
Expected Savings	Proposed plan energy savings
Savings Unit Lookup	Options for recorded unit of savings
Expected Participation	Estimated quantity of participating entities or rebates
Participation Units	Options for recorded or implied units of expected participation, such as measures or customers
Budgeted Direct to Customer	Plan Dollars budgeted for incentives or value to the customer over the plan program year(s)
Budgeted, Admin or Indirect	Plan Dollars budgeted for operating the programs, outside incentives, over the plan program year(s)
Budgeted Program Total	Total Plan Dollars over the plan program year(s)
Budget Includes Lookup	Options for types of budget items included--somewhat obsolete with addition of budget items above
Actuals Document Type Lookup	Type of document recording achievements of a program, such as an evaluation report or a report to the commission
Achieved Start Year	Year 1 of the program for which data were found
Achieved Yrs. Covered LOOKUP	Duration of the program reported
Achieved Savings	Actual recorded energy savings (may be gross, net, or undefined)
Achieved Savings Unit Lookup	Options for unit of savings reported

Field Name	Description
Achieved Participation	Achieved quantity of measures, rebates, or customers in the programs
Participation Units	Options for recorded or implied units of actual participation, such as measures or customers
Actual Expenditure Direct to Customer	Program dollars reported as spent on incentives or value to the customer over the reported program year(s)
Actual Expenditure, Admin or Indirect	Program dollars reported as spent on operating programs other than incentives over the reported program year(s)
Actual Expenditure Program Total	Total program dollars reported over the program year(s)
Program Offerings Lookup	Types of services and/or incentive mechanisms proposed or reported for a program
Primary End-uses Targeted Lookup	Types of building end-uses proposed or reported for a program
Fuel Lookup	Types of energy resources proposed to be saved or saved—electricity and/or gas, or other fuels
% of Sector Budget/Spend	Of a proposed or reported budget for a given program, this item presents how much of that budget was spent on this sector and program, usually 100% if budgets are disaggregated by program/line item. It is only less than 100% if a more aggregated (portfolio) budget is recorded from the documentation, but specific program spending can be otherwise estimated.
End-use %	Fields to record or estimate the percent of proposed or actual spending allocated to typical building end-uses. Lighting, Heating, Air Conditioning, Water Heating, Ventilation, Refrigeration, and Other end-uses were defined.
Non-Savings Spend %	This field was used to record proposed or actual spending line items that were attributed to portfolio wide administrative activities with no particular program distributions in the documentation. This field should generally have a value of 100% if its corresponding budget item is designated as non-savings; or blank if the recorded budget item is allocated to end uses.

Data availability

Most sampled utilities provide EE program plans, evaluation reports, annual progress reports, and other documentation that are fully disclosed to the public via commission websites. However, some utilities redact budget and savings information provided in those documents. Kansas City Power & Light and Ameren Missouri in the West North Central CD and Duke Energy in the East South Central CD redact budget or cost information to some extent. Utilities which voluntarily offer EE programs less frequently provide formal documentation of their programs.

The availability of both proposed and actual spending data for a given program in a given program cycle was less prevalent than expected. Many state commissions require regulated utilities to conduct evaluation of their programs and report on results regularly, but not annually, and not for every program. New York State utilities were found to have irregular and infrequent program evaluation requirements. Publicly-available, annually-reported program achievements were provided on the New

York Public Service Commission website at a highly aggregated level for utilities.

How utilities report budgets varies by utility and state. They may or may not differentiate direct-to-customer spending for incentives and services, and they may differ in what they consider direct-to-customer spending; some utilities may call technical assistance provided by an implementation contractor a customer benefit, while others may call it an administrative or implementation cost, separate from the customer incentive. In addition, utilities may designate program-specific budgets as well as line items for portfolio-wide activities such as marketing or activities of utility staff, whose allocation to programs is not obvious.

Proposed or achieved participation levels are not consistently reported in plans or annual reports. Where they are reported, the participant definition is not always clear. Some prescriptive programs count individual units of equipment as participation, while more comprehensive incentive programs may count customers or projects.

Infrequently, a utility serving electric and natural gas customers may quantify their proposed or actual energy savings in equivalent energy units and/or combine program budgets, without differentiating fuel source.

Descriptions of program offerings in plans and evaluation reports are limited—often the plan is written to maximize flexibility in delivering a given program, especially those that cover multiple measures; while evaluation may focus on the programs and measures that bring the majority of savings. More frequently, utility documents report on claimed savings allocations to end-use rather than budget allocations to end-use.

These factors contributed to limited data availability for some Census divisions, which may make comparisons among types of budget and spending data collected, or among Census divisions, difficult.

Data Analysis and Results

Qualitative Data Analysis

A number of assumptions were required to attribute reported EE program spending and savings data to typical program offerings and end-uses, where those attributions were not always explicit in the documents. For example, a utility may describe a budget item as an ENERGY STAR Products program, which may be limited to certified lighting products, or may encompass a variety of certified equipment. Utility websites or evaluation reports often provide the necessary program descriptions. Where those descriptions were not found or not clear, Leidos used professional judgment to determine likely program offerings that could then be assumed to have a certain budget profile by end-use.

End-use Consumption Allocations

Due to the greater prevalence of planned or reported allocations of energy *savings* to end-use in EE program documentation, Leidos applied those where available as a proxy for how program *spending* can be attributed to end-use. Where no such data could be obtained, Leidos applied its experience designing and implementing EE programs for utility clients throughout the U.S. Default allocations were determined for various typical program types, and reviewed by various Leidos Program Managers and senior program staff. A list of typical EE program types and their assumed budget allocations by end-use are provided in Appendix 2.

The assignment of default (or reported) budget allocations to utility programs then allowed the calculation of end-use spending per program year, by Census division, sector, energy resource type, and

spending category (high, medium, low, no spend, no sales). In general, the calculations were performed as follows, where i refers to the individual recorded program offerings, and j refers to the typical building end-uses defined for this analysis.

$$End_Use_ \$_{ij} = \frac{Program_ \$_i * end_use\%_j}{Program_Yrs}$$

$$End_use_ \$_j = \sum_i (End_Use_ \$_{ij})$$

Utility EE Program End-Use Spending

Average end-use spending was initially explored as the appropriate metric. However, a number of recorded programs had insufficient spending or savings data to derive real weighted average end-use spending estimates. In addition, program spending for which the utility explicitly claimed zero proposed or actual savings is not correctly accounted for in this approach. It was decided to report sums of end-use spending rather than weighted averages.

Because of the stated data availability issues, the most complete set of data for comparison by Census division exists for total EE program budgets (total including incentives and administrative costs, vs. incentives only). A summary of these total program budgets estimated by end-use for CD 1-9 is shown in Table 4, suggesting some differentiation by region in annual program spending. High estimated annualized budgets in CD 2 for residential heating end-use are attributed to multi-million dollar budgets set by NYSERDA for Empower NY, a weatherization program with both electric and gas budgets for 2012-2015; and by the New Jersey statewide gas program for 2012. CD 1, 6 and 9 all show high non-savings, sector-neutral budget estimates: these are attributed to conservation and load management loan defaults by Connecticut Light & Power that were not explicitly designated as residential or commercial in their filed plan; administrative and educational budgets for Kentucky Utilities and Louisville Gas & Electric; and several sector-neutral budget items among California and Washington utilities, respectively.

These data represent budgets provided for any and all reported and recorded ⁷ program types found in the program documents available for the sampled utilities. Some utility plans or reports include both efficiency offerings and demand response offerings, others separate kWh-saving programs from initiatives that are designed to shift peak loads, or to promote renewable generation. Leidos excluded out of scope load-shifting and renewable programs and budgets where they were documented as completely separate and distinct from an energy conservation portfolio. Some of these budgets are being spent on programs and initiatives that are expected to indirectly influence energy efficiency and building equipment selection, rather than to directly motivate purchase of more efficient equipment

⁷ In three cases, due to quantity of a utility's program offerings, Leidos limited the sampled programs to those contributing the majority of overall savings and/or having the most complete data available: Municipal Energy Agency of Nebraska; Tennessee Valley Authority; and San Diego Gas & Electric.

and building features.

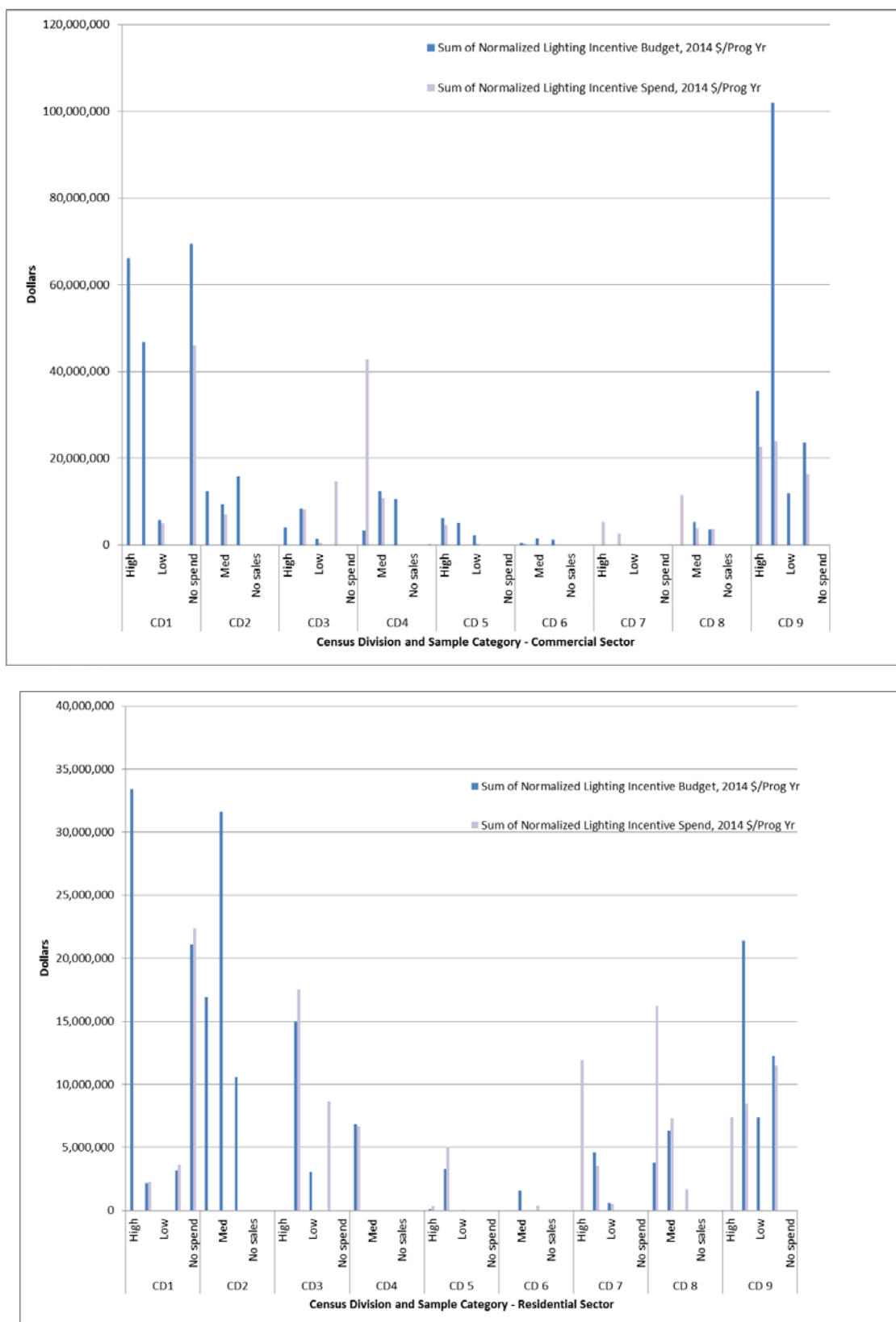
Spending data were not normalized to savings or program participants, because the program documentation lacked sufficient data for a consistent comparison among spending categories and Census divisions.

Table 4. Total (Sample) Electric Spending Per Annualized Program Year, by End-Use

Sector & Census Divisi	Lighting 2014 \$/ Prog Yr	Heating 2014 \$/Prog Yr	A/C 2014 \$/ Prog Yr	Water Heating 2014 \$/Prog Yr	Ventilation 2014 \$/Prog Yr	Refrigeration 2014 \$/Prog Yr	Other End Use 2014 \$/Prog Yr	Non Savings 2014 \$/Prog Yr
Commercial	1,024,316,303	179,304,528	211,212,065	44,141,322	29,838,339	22,016,984	69,864,831	49,351,642
1	250,544,824	44,756,577	53,813,898	9,966,995	7,146,395	4,721,070	6,619,023	4,726,038
2	150,153,511	25,719,853	34,053,308	5,536,261	4,756,737	2,788,818	21,855,278	0
3	131,729,152	47,174,617	22,191,397	14,346,647	6,028,287	3,206,258	12,560,182	19,977,581
4	64,086,403	13,787,258	12,066,727	3,950,863	1,999,586	1,132,442	14,383,437	3,815,275
5	60,323,207	4,576,931	11,264,807	817,849	1,566,224	1,462,013	2,534,051	4,581,258
6	6,892,980	818,588	3,924,753	92,406	175,649	176,222	843,745	63,069
7	12,429,699	743,279	1,783,870	148,656	297,312	297,312	445,967	0
8	14,929,620	1,194,057	5,401,857	276,847	348,619	361,436	535,745	8,143
9	333,226,908	40,533,370	66,711,449	9,004,797	7,519,531	7,871,414	10,087,402	16,180,277
Residential	735,657,414	421,989,413	235,673,672	88,588,250	444,227	34,594,226	56,760,626	46,399,150
1	121,398,057	83,500,981	31,629,943	11,680,778	187,854	5,159,239	9,121,412	6,919,768
2	156,556,722	187,037,661	49,621,508	34,506,378	68,731	5,258,277	1,986,448	1,801,372
3	63,413,512	40,183,499	21,310,316	9,063,494	45,850	4,295,497	10,785,795	8,837,832
4	9,514,543	10,834,862	5,680,162	4,935,994	7,197	323,022	723,456	968,000
5	33,853,354	7,420,728	14,951,481	1,764,965	9,609	2,551,620	5,561,440	14,981,601
6	13,485,117	5,036,985	11,355,514	501,713	0	2,077,970	115,906	0
7	20,904,101	3,660,718	8,902,494	956,637	108,288	221,100	275,244	0
8	26,313,287	7,170,966	33,053,883	2,698,156	0	4,635,677	1,666,489	7,185,812
9	290,218,721	77,143,014	59,168,370	22,480,134	16,696	10,071,824	26,524,436	5,704,764
Sector Neutral	178,278,740	13,524,671	36,354,771	3,151,396	3,421,637	3,888,058	6,158,047	262,476,586
1	0	0	0	0	0	0	0	167,052
2	2,115,149	1,003,338	294,193	226,768	1,444	15,720	16,442	0
3	0	0	5,471,347	0	0	588,567	1,294,848	0
4	738,677	317,605	1,674,537	101,810	0	5,091	7,636	0
6	0	0	0	0	0	0	0	141,309,470
7	0	0	695,056	0	0	0	0	1,284,263
8	0	0	5,141,157	0	0	0	0	407,173
9	175,424,915	12,203,728	23,078,480	2,822,818	3,420,193	3,278,680	4,839,122	119,308,627
Grand Total	1,938,252,457	614,818,612	483,240,508	135,880,968	33,704,203	60,499,268	132,783,505	358,227,377

Figure 2 illustrates the variation in annualized customer incentive budgets among the defined utility spending categories as well as among Census divisions. Incentive budgets and spending attributed to lighting are shown. In general, utilities characterized as “low” EE program spenders per unit of sales appear to budget and spend less on customer incentives than utilities characterized as “high”. A number of utilities categorized as “no spend” utilities – reporting retail electricity sales on EIA-861, but not appearing in the accompanying EE program spending data set – were found to offer programs via review of their websites or state commission documents. The large lighting budget in the CD 1 “no spend” sample category is driven by multi-million dollar budgets and spending by NSTAR, a Massachusetts utility. A number of “no spend” utilities described programs on websites but no documentation could be found to support budget estimates.

Figure 2. Comparison of Average Program Year Lighting Budgets by Sector and Census Division



Conclusions

Anecdotal evidence and past research and analysis suggest that regional differences in spending on specific programs and the types of building end-uses served in those programs are likely to exist, if only because efficient equipment cost differences are known to exist geographically, and many EE programs are designed to cover a fixed percent of equipment costs. The results of this project suggest that, without accounting for program maturity, one region of the U.S. may be subject to different utility spending than another for a given building end-use offering. In addition, within a region, there is variation in sales-normalized spending among utilities. Further development of this research is hoped to reveal more definitive regional variations in EE spending across the U.S., of interest for inclusion in EIA's National Energy Modeling System.

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Appendices

- A1. Full Sample of Utilities by Census Division

A2. EE Program Types and Assumed End-use Allocations

- UTILITY SAMPLE SELECTIONS
- ranked utilities by MWh sales (residential vs. commercial)--selected those contributing top 50% of sales (additional top sales are incremental and result in an unmanageably long list of utilities)
 - ranked utilities by EE spend per sales unit (per customer for res, per MWh for comm)
 - joined two lists and selected utilities that met the following 5 category descriptions

RESIDENTIAL

Utilities in top 50% sales and distributed by program spend per customer	CD1	CD2	CD3	CDD4	CD5	CD6	CD7	CD8	CD9
High Spend per customer	(MA) Massachusetts Electric Co; (RI) The Narragansett Electric Co	(PA) PECO Energy Co**; (PA) PPL Electric Utilities Corp;	Duke Energy Indiana; (IL) Ameren Illinois Company	(IA) Interstate Power and Light Co	(FL) Florida Power & Light Co; (MD) Baltimore Gas & Electric Co**	(KY) Kentucky Utilities Co; (KY) DukeEnergy Kentucky	City of San Antonio - (TX); (OK) Public Service Co of Oklahoma	(AZ) Salt River Project; (AZ) Arizona Public Service Co	(WA) Puget Sound Energy Inc**; (CA) Sacramento Municipal Utility District
Med Spend per customer	(CT) Connecticut Light & Power Co; (NH) Public Service Co of NH	(NJ) Public Service Elec & Gas Co ³ ; (NY) Consolidated Edison Co-NY Inc**; (NJ) Jersey Central Power & Lt Co	(IL) Commonwealth Edison Co; (MI) Consumers Energy Co**	(KS) Westar Energy Inc	(NC) Duke Energy Carolinas, LLC; (GA) Georgia Power Co	(MS) Mississippi Power Co; (KY) Louisville Gas & Electric Co	(AR) Entergy Arkansas Inc; (TX) Entergy Texas Inc.	(CO) Public Service Co of Colorado**; (NV) Nevada Power Co	(CA) Pacific Gas & Electric Co**; (CA) Southern California Edison Co
Low Spend per customer	(ME) Central Maine Power Co	(NY) Niagara Mohawk Power Corp.**; (NY) New York State Elec & Gas Corp	(OH) The Toledo Edison Co, a FirstEnergy company	(KS) Kansas City Power & Light Co	(VA) Virginia Electric & Power Co	(AL) Alabama Power Co; (KY) Kentucky Power Co	(TX) Southwestern Public Service Co	(NV) Sierra Pacific Power Co; (NM) Public Service Co of NM	(CA) San Diego Gas & Electric Co**; (WA) Avista Corp
No sales (third party)	(ME) Efficiency Maine Trust; (VT)Vermont Energy Investment Corporation; (MA) Cape Light Compact	NYSERDA	WI Focus On Energy	none selected	Tennessee Valley Authority--GA, VA	Tennessee Valley Authority--KY,TN, AL	none selected	none selected	Energy Trust of Oregon
No spend	(MA) NSTAR Electric Company	none selected	none selected	(IA) Municipal Energy Agency of NE; (MN) Great River Energy	none selected	none selected	(TX) TXU Energy Retail Co LP; (TX) Constellation NewEnergy, Inc	none selected	none selected

COMMERCIAL

Utilities in top 50% sales and distributed by program spend per MWh sold	CD1	CD2	CD3	CD4	CD5	CD6	CD7	CD8	CD9
High Spend per MWh sold	(MA) Massachusetts Electric Co; (RI) The Narragansett Electric Co	(NY) Long Island Power Authority; (NY) New York Power Authority; (PA) PPL Electric Utilities Corp; (NY) Consolidated Edison Co-NY Inc	(MI) Consumers Energy Co*; (OH) Cleveland Electric Illuminating Co	(MN) Northern States Power Co*; (IA) MidAmerican Energy Co*	(MD) Baltimore Gas & Electric Co; (MD) Potomac Electric Power Co	(KY) Kentucky Power Co	City of San Antonio - (TX); (OK) Public Service Co of Oklahoma	(AZ) Arizona Public Service Co; (AZ) Salt River Project	(CA) Pacific Gas & Electric Co*; (CA) San Diego Gas & Electric Co*
Med Spend per MWh sold	(CT) Connecticut Light & Power Co; (CT) United Illuminating Co	(PA) Metropolitan Edison Co; (PA) Pennsylvania Electric Co; (PA) West Penn Power Company	(IL) Commonwealth Edison Co; (MI) The DTE Electric Company	(MO) Kansas City Power & Light Co; (IA) Interstate Power and Light Co*	(FL) Duke Energy Florida, Inc; (FL) Florida Power & Light Co;	(KY) Louisville Gas & Electric Co	(TX) Austin Energy	(UT) PacifiCorp; (NV) Nevada Power Co	(CA) Southern California Edison Co; (WA) Puget Sound Energy Inc*
Low Spend per MWh sold	(ME) Central Maine Power Co; (NH) Public Service Co of NH	(NY) Niagara Mohawk Power Corp.*; (NJ) Public Service Elec & Gas Co; NY State Elec & Gas Corp	(IN) Duke Energy Indiana Inc; (IN) Northern Indiana Pub Serv Co*	(MO) Union Electric Co; (SD) Black Hills Power	(GA) Georgia Power Co; (VA) Virginia Electric & Power Co	(KY) Kentucky Utilities Co; (KY) Duke Energy Kentucky	(OK) Oklahoma Gas & Electric Co	(NM) Public Service Co of NM; (WY) PacifiCorp	(CA) Los Angeles Department of Water & Power; (CA) PacifiCorp
No sales (third party)	(ME) Efficiency Maine Trust; (MA) Cape Light Compact	NYSERDA	WI Focus On Energy	none selected	TVA (GA, NC)	TVA (KY, MS,AI,TN)	none selected	none selected	(OR) Energy Trust of Oregon
No spend	(MA) Direct Energy Business ¹ ; (MA) Constellation NewEnergy, Inc ² ; (MA) NSTAR Electric Company; (CT) Constellation NewEnergy, Inc	PA Constellation NewEnergy; PA FirstEnergy Solutions ⁴ ; (NJ) Jersey Central Power & Lt Co	(IL) Constellation NewEnergy, Inc; (WI) Wisconsin Electric Power Co	(IA) Municipal Energy Agency of NE; (MN) Great River Energy	none selected	(AL) Alabama Power Co: (MS) Mississippi Power Co	(TX) TXU Energy Retail Co LP; (TX) Constellation NewEnergy, Inc	none selected	none selected

Footnotes

- Direct Energy Business does not appear to be a utility; it may be a reporting convention.
- Program documentation for Constellation NewEnergy in various states could not be found.
- NJ Statewide programs were reported.
- FirstEnergy Solutions likely appeared in this category because programs are delivered by individual operating companies that comprise FirstEnergy. Those companies are represented in other categories.

* A 2012 Top 50 commercial sector gas seller, according to the American Gas Association

** A 2012 Top 50 residential sector gas seller, according to the American Gas Association

Fuel	Sector	End Use Allocation Program Types	Program Description	Lights	Heat	A/C	Water Heating	Ventilation	Refrigeration	Other
ELECTRIC RESOURCE CONSERVATION	Commercial	EL_CI_Comprehensive Prescrip/Custom	Includes per unit equipment rebates and performance-based incentives that cover a range of end uses	75%	5%	12%	1%	2%	2%	3%
		EL_CI_Cooling and Heating	Limited to HVAC equipment and service	0	30%	70%	0	0	0	0
		EL_CI_Heating and Water Heating	Space and water heating equipment and service	0	85%	0	15%	0	0	0
		EL_CI_New Construction (WB+Prescrip)	Incentives and technical assistance for new building design	50.0%	10.0%	30.0%		5.0%	0.5%	0.5%
		EL_CI_Not End Use Spending	Indicates budget items that are attributed to utility or contractor marketing, R&D, or administrative work not specific to programs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		EL_CI_Unknown Program Type	the efficiency strategy intended by the program is unclear	75%	5%	12%	1%	2%	2%	3%
		EL_CI_Whole Building Retrofit	incentives and technical assistance for major renovations	70.0%	15.0%	10.0%	4.0%	0.0%	0.5%	0.5%
	Residential	EL_Res_Appliance	incentives covering new equipment or equipment recycling	0	0	20%	0	0	25%	55%
		EL_Res_Comprehensive Prescriptive	Includes per unit equipment rebates and performance-based incentives that cover a range of end uses	75.0%	10.0%	10.0%	4.0%	0.0%	0.5%	0.5%
		EL_Res_Cooling and Heating	Limited to HVAC equipment and service	0	25%	75%	0	0	0	0
		EL_Res_Heating and Water Heating	Space and water heating equipment and service	0	85%	0	15%	0	0	0
		EL_Res_New Construction (WB+Prescrip)	Incentives and technical assistance for new building design	70.0%	15.0%	10.0%	4.0%	0.0%	0.5%	0.5%
		EL_Res_Not End Use Spending	Indicates budget items that are attributed to utility or contractor marketing, R&D, or administrative work not specific to programs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		EL_Res_Sealing and Insulation/Audits	Home Performance with ENERGY STAR often promotes air leak sealing and audit of energy savings opportunities	0	75%	25%	0	0	0	0
		EL_Res_Unknown Program Type	the efficiency strategy intended by the program is unclear	70.0%	15.0%	10.0%	4.0%	0.0%	0.5%	0.5%
		EL_Res_Whole Building Retrofit	incentives and technical assistance for major renovations	70.0%	15.0%	10.0%	4.0%	0.0%	0.5%	0.5%
NATURAL GAS OR FUEL RESOURCE CONSERVATION	Commercial	NONEL_CI_Comprehensive Prescrip/Custom	Includes per unit equipment rebates and performance-based incentives that cover a range of end uses	0	70%	0	23%	5%	0	2%
		NONEL_CI_Cooling and Heating	Limited to HVAC equipment and service	0	100%	0	0	0	0	0
		NONEL_CI_Heating and Water Heating	Space and water heating equipment and service	0	85%	0	15%	0	0	0
		NONEL_CI_New Construction (WB+Prescrip)	Incentives and technical assistance for new building design	0	70%	0	23%	5%	0	2%
		NONEL_CI_Not End Use Spending	Indicates budget items that are attributed to utility or contractor marketing, R&D, or administrative work not specific to programs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		NONEL_CI_Unknown Program Type	the efficiency strategy intended by the program is unclear	0	70%	0	23%	5%	0	2%
		NONEL_CI_Whole Building Retrofit	incentives and technical assistance for major renovations	0	70%	0	23%	5%	0	2%
	Residential	NONEL_Res_Appliance	incentives covering new equipment or equipment recycling	0	0	0	99%	0	0	1%
		NONEL_Res_Comprehensive Prescriptive	Includes per unit equipment rebates and performance-based incentives that cover a range of end uses	0	75%	0	24%	0	0	1%
		NONEL_Res_Cooling and Heating	Limited to HVAC equipment and service	0	100%	0	0%	0	0	0
		NONEL_Res_Heating and Water Heating	Space and water heating equipment and service	0	85%	0	15%	0	0	0
		NONEL_Res_New Construction (WB+Prescrip)	Incentives and technical assistance for new building design	0	75%	0	24%	0	0	1%
		NONEL_Res_Not End Use Spending	Indicates budget items that are attributed to utility or contractor marketing, R&D, or administrative work not specific to programs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		NONEL_Res_Sealing and Insulation/Audits	Home Performance with ENERGY STAR often promotes air leak sealing and audit of energy savings opportunities	0	100%	0	0	0	0	0
		NONEL_Res_Unknown Program Type	the efficiency strategy intended by the program is unclear	0	75%	0	24%	0	0	1%
		NONEL_Res_Whole Building Retrofit	incentives and technical assistance for major renovations	0	75%	0	24%	0	0	1%