Independent Statistics & Analysis
U.S. Energy Information Administration

Analysis of Energy Efficiency Program Evaluation, Measurement, and Verification (EM&V) Reports: Residential Space Cooling and Commercial Lighting Measures

March 2014

About the Report

The U.S. Energy Information Administration (EIA) conducted a one-time inventory of evaluation, measurement and verification (EM&V) reports in 2013 to research general cost information in state-mandated energy efficiency program evaluations. Using the one-time inventory as a sampling frame for further analyses, the end-use services of residential space cooling and commercial lighting were selected for continued research and analysis. EIA targeted these end-use services because both end uses are prevalent services throughout the United States and for their popularity in both new and maturing energy efficiency incentive programs.

Energy efficiency program budgets have rapidly expanded, and in many states program budgets now approach supply-side capital investment in scale.[1] But the high variability of energy efficiency programs, the lack of lengthy track records, and the difficulty of measuring their benefits make analyzing these programs challenging, particularly in comparing them across states or across energy service areas. A large number of programs are currently generating an ever-growing number of EM&V studies and many entities are developing tools and suggesting approaches that can be applied nationwide to improve consistency of reporting in this area. In this contracted report, EIA seeks to compare results, address its analytic and modeling needs, and also provide a resource for studying reporting techniques used in energy efficiency programs across the country.

The National Energy Modeling System (NEMS) is the primary technical system used by EIA and the federal government for domestic, long-term energy forecasting and analysis. This report supports enhancement of the Residential Demand Module (RDM) and Commercial Demand Module (CDM), which are major components of NEMS that project energy consumption for marketed energy sources plus distributed solar and geothermal energy. Both the RDM and CDM include projections of energy consumption by end-use service through 2040.[2]

The contracted report includes data collection methodology and analysis of efficiency measures associated with residential space cooling and commercial lighting end uses, as well as a normative analysis of the data available in sampled EM&V reports. As could be expected given the relatively sparse and inconsistent data, results are not conclusive, although they do suggest that increased program spending is associated with greater consumer investment. At EIA's request, the contracted report includes specific areas where EM&V reporting could be made more useful for the types of analysis that EIA conducts, as well as methodological discussion that could be of interest for other researchers.

Proper citation of this report is requested – i.e., prepared by Leidos Engineering, LLC for the U.S. Energy Information Administration.

See complete report

[1] Consortium for Energy Efficiency (CEE), *Growth Trends in the Energy Efficiency Industry*, Forster, Hilary; Wallace, Patrick; Dahlberg, Nick, April 5, 2013, website http://www.cee1.org/content/growth-trends-energy-efficiency-industry, accessed March 5, 2014.

[2] Additional information on EIA's modeling of residential and commercial energy projections can be found in the RDM and CDM model documentations, located at http://www.eia.gov/reports/index.cfm?t=Model%20Documentation.

Disclaimer

EOP III TASK 4243, SUBTASK 2 – ANALYSIS OF ENERGY EFFICIENCY EVALUATION, MEASUREMENT, AND VERIFICATION REPORTS

Final Report #2 for Subtask 2.2: Measure Cost Analysis

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Introduction

In 2012, the U.S. Energy Information Administration (EIA) contracted SAIC (now Leidos) to contribute to Task 4243, Subtask 2, *Analysis of Energy Efficiency Evaluation, Measurement and Verification Reports*. The task supports the EIA goal of quality improvement to maintain relevancy and consistency with changing energy markets. Leidos delivered a report and inventory of energy efficiency program evaluation, measurement and verification reports throughout the U.S., by state, in December 2012. In July 2013, Leidos delivered a report and database of energy efficiency measure cost data for a sample of 10 states. At that time, the EIA approved additional funding to continue developing the measure cost database and analysis of efficiency equipment markets for all states.

In December 2013, the EIA and Leidos agreed to a final scope of work that included data collection and analysis of efficiency measures associated with residential space cooling and commercial lighting end uses. In addition, the EIA requested a normative analysis of the data available in utility EM&V reports; e.g.,

- What data should be reported to extend the value of publicly-available, regulatory reports to inform market analysis and research?
- And if that data were comprehensively available, what would its analysis look like?

This report summarizes the findings of the available data review in energy efficiency programs throughout the U.S., and suggests opportunities to augment program data and reporting for more rigorous analysis of the impacts of efficiency programs on the market for efficiency equipment products.

Program Report Analysis Approach

Commercial lighting and residential space cooling were selected for continued research and analysis, as prevalent end uses throughout the U.S., often included in both new and maturing utility efficiency incentive programs.

All program reports listed in the Subtask 2.1 report inventory were briefly reviewed for relevance to this task. Those reports not addressing the specified end uses were omitted from the final list.

As for Subtask 2.1, the efficiency program inventory, a few states were not researched due to lack of programs and/or program data: Alaska, South Dakota, and Mississippi. In addition, California data were omitted from the analysis due to the magnitude of data and program analysis available in the literature.

The research focus was largely on prescriptive rebate programs targeted to 'regular' customers. Programs that targeted special customer segments, such as Low Income or Multifamily; and programs that were largely service provisions, such as audit, direct install, and weatherization programs, were omitted. Incremental improvements and adjustments to building systems, rather than equipment upgrades, are typical of these programs and are often offered at no cost to the customer. Total utility costs for these programs per unit energy savings are therefore higher than for prescriptive equipment programs as a result of these factors. The market factors driving the provision of these types of programs, and customer participation in them, may not be indicative of the equipment markets NEMS simulates.

Budget and expense data were normalized to unit energy savings in million British Thermal Units (MMBTU) for comparison. Some programs claimed both fuel and electricity savings and did not differentiate program budgets or expenses for these energy end uses.

Further research turned up no evidence of programs or program reports covering these end uses for North Carolina, Georgia, Kentucky, Tennessee, Louisiana, Kansas, Nebraska, and North Dakota. FirstEnergy in West Virginia is administering a lighting incentive program, but no EM&V or other reporting activity could be found. In a few instances, previously inventoried program evaluation and annual regulatory reports could not be relocated.

Previously covered states—Massachusetts, New York, Oregon, Vermont, Hawaii, Ohio, Florida, Virginia, South Carolina and Missouri—were not included in this report, except where multi-state programs were reviewed (e.g. Massachusetts).

Program and Measure Data Analysis

Despite the general common goal of demonstrating cost-effective use of public or ratepayer funds to meet energy savings goals, utility program data varied widely among reviewed reports. **Table 1** summarizes where relevant data could be found among the programs and end uses reviewed, that may inform measure savings and costs estimates. As expected, a greater number of reports contained program level savings and cost estimates, than contained measure level savings and cost estimates.

Most reports differentiated verified program savings from gross (unadjusted claimed) program savings. Fewer reports included net program savings, where adjustments are made to claim only those savings attributed to program availability.

- Verified savings typically refer to savings estimates that have been adjusted for confirmed installation, and/or for corrections to technical estimating methods or assumptions. These savings estimates may be best suited for capture in the NEMS model: gross savings can overstate real savings when they incorporate calculation errors and claimed savings for ineligible or removed projects; net savings are adjusted relative to gross or verified to remove savings that are not directly attributed to the program, and/or add savings not paid for by the program.
- Net savings are typically lower than gross or verified, and would overlook real captured equipment and customer data that the utility could not claim toward their savings goals due to program rules.

Data availability by region:	Verified Annual Program Savings?	Net Annual Program Savings?	Total Program Costs?	Program Participant Costs?	Measure Level Participant Costs?	Measure Level Unit Savings?
Northeast New England	CT, MA, NH, ME	ME	MA, ME, RI	ME	CT, ME, NH	ME
Northeast Mid Atlantic	PA	PA, NJ	PA, NJ	PA		NJ
South S. Atlantic	MD, DE	MD, DE	MD	MD	MD	MD
South ESC						
South WSC	AR, OK	AR, OK	AR, OK			AR
Midwest WNC	MN		MN			
Midwest ENC	MI, WI, IN	MI, WI, IN	MI, WI, IN	WI		MI
West Pacific	WA, OR		WA			OR, WA
West Mtn	CO, ID, NV, NM, WY, MT	CO, ID, NM, WY, AZ, MT	CO, ID, UT, NV, NM, WY, AZ	CO	CO, NM	CO, MT, NM, WY

Table 1 Availability of Measure Data by Region

State Efficiency Program Total Spending History

The American Council for an Energy Efficient Economy (ACEEE) annual State Energy Efficiency Scorecard reports gas and electric efficiency program spending at the state level, typically provided by public service commissions overseeing the programs. **Figure 1** illustrates total spending by state for the last 4 years[1]. While spending will likely correlate to a variety of demographic and market factors, such as population, utility customer base, electricity and gas prices, spending may also tie to the level of program experience in the state. As seen below, states renowned for efficiency program histories—California, New York, Massachusetts, and

New Jersey—were the highest spenders in the U.S. in 2012. Analysis of how efficiency programs have affected state by state energy equipment prices should take into account the overall financial support available for such programs.

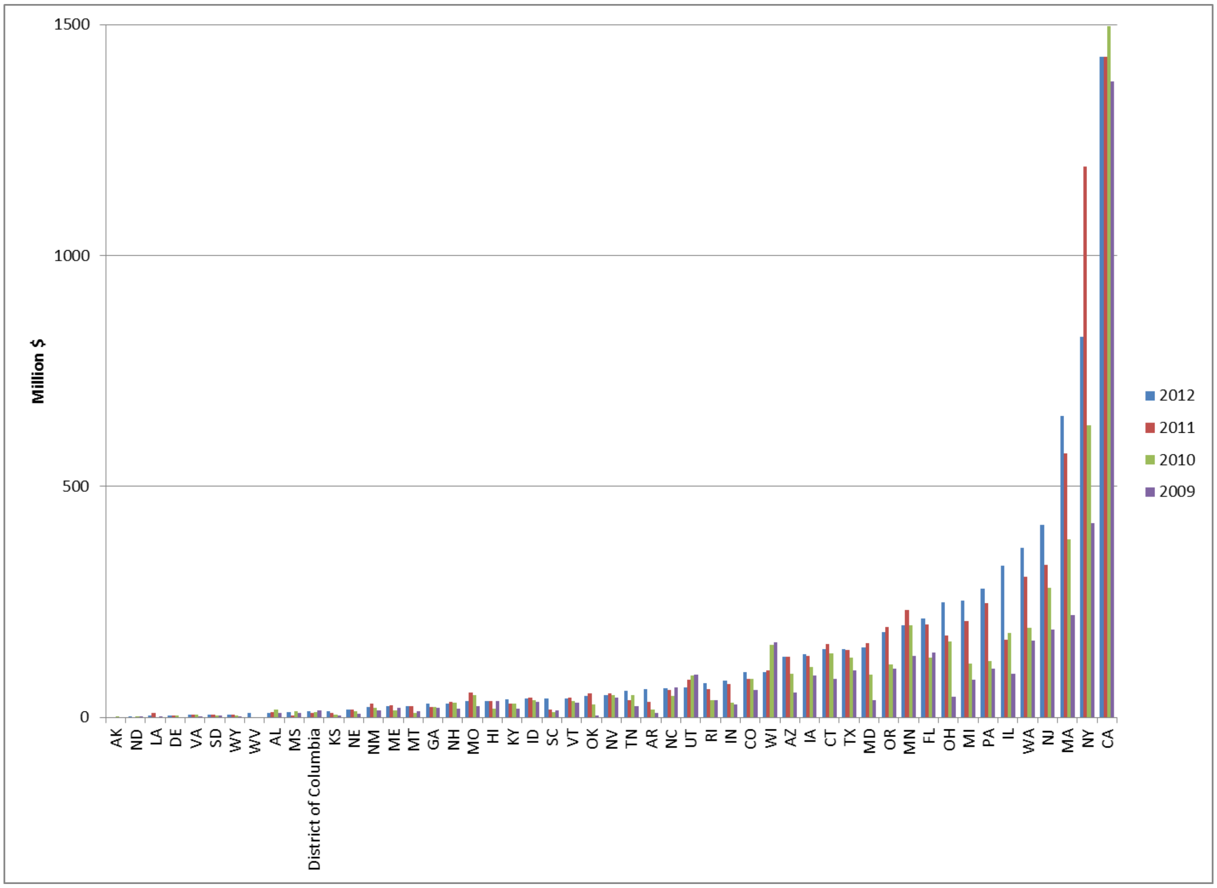

Figure 1 Efficiency Spending by State as reported by the American Council for an Energy-Efficient Economy, 2009-2012

Residential Space Cooling

Several utilities reported savings, budgets and/or expenses for programs covering multiple end uses, which included residential space cooling. While this data is not solely representative of space cooling (often including heating, lighting and/or appliances), it was included in this analysis to improve the overall quantity of available data. Several projects offered multiple pathways for residential incentives, such as whole-home programs, prescriptive equipment programs, and ENERGY STAR.

A number of program evaluation reports included unit incentive data for residential HVAC and space cooling, but only a few equipment unit costs were found in Colorado and New Mexico. In 2008, one New Mexico utility estimated the unit cost of a heat pump retrofit was on average $632; while a 2009 New Mexico program estimated that a residential heat pump project would cost $2500. In 2009, a Colorado evaporative cooling program estimated that lower tier equipment would cost a customer $941, while upper tier equipment would cost $2550.

Figures 2-4 compare total state program spending to individual utility program budget rates for promoting, administering, incenting, and evaluating residential HVAC improvements. We examined budget rates (per MMBTU goals) with the premise that a state's overall spending would have a direct relationship to the utilities' budgets; e.g. a state with higher efficiency spending would correlate with higher spending per unit savings.

Roughly speaking, Southwest and South Central states reporting this data were budgeting $100-400 per MMBTU goal; Maryland and Michigan were expecting to spend $50-$150 per MMBTU; and Western states were budgeting $100-200 per MMBTU. However, budget rates appear relatively flat when compared to total state efficiency expenditures, with a possible exception in the Western U.S., where increasing state spending appears to be associated with higher utility budget rates. In general, Southern and Western U.S. utilities might be expected to allocate more budget for space cooling measures for their hot climates, than Midwestern and Northeastern utilities. However, budget *rates* may not illustrate this expectation, as savings from space cooling in regions with hotter weather for longer seasons would also be larger than in cooler regions.

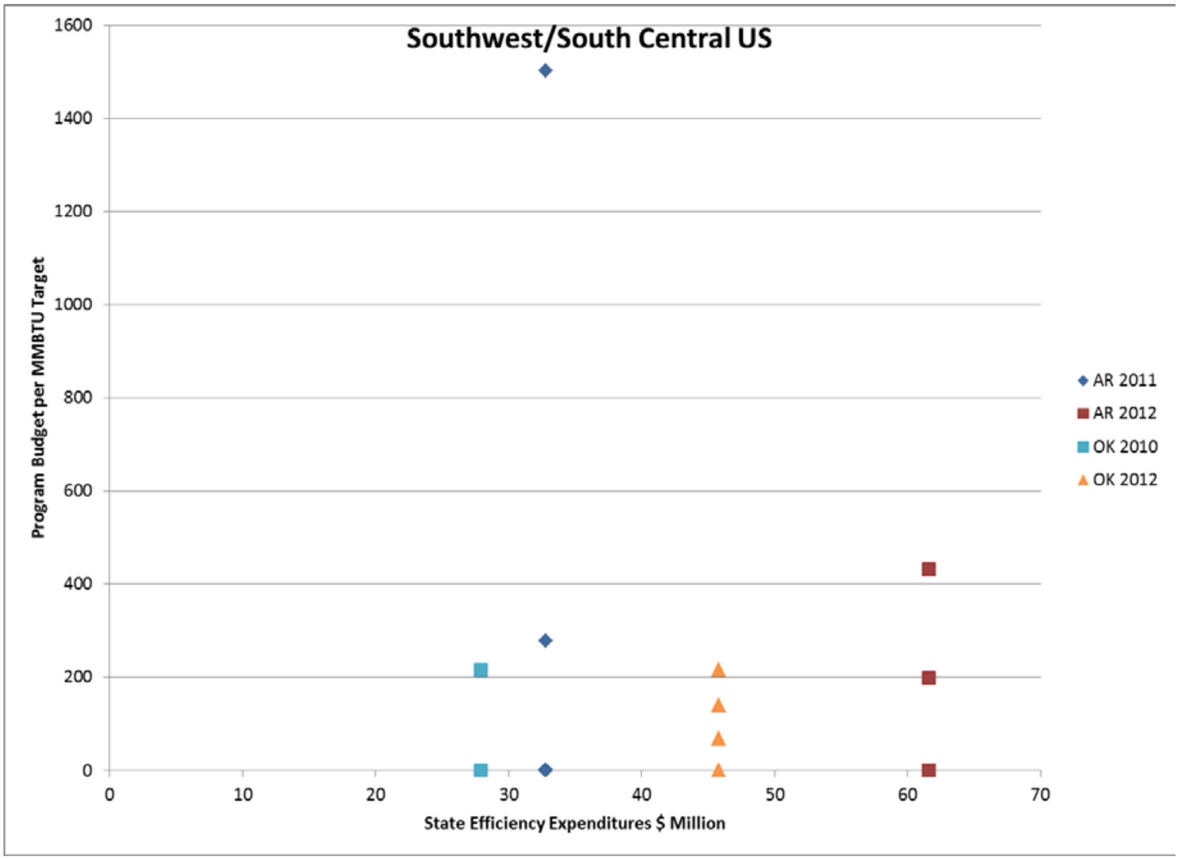

Figure 2 Residential HVAC Budget Rates vs. State Spending in the Southwest and South Central U.S.

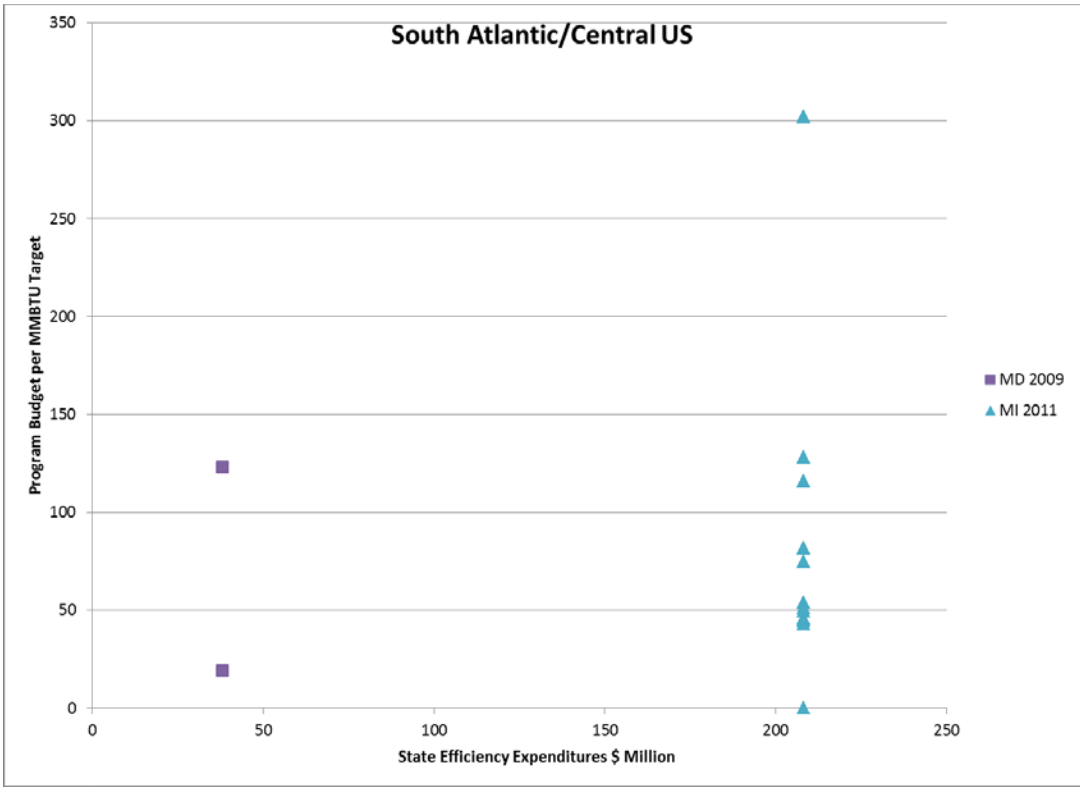

Figure 3 Residential HVAC Budget Rates vs. State Spending in the South Atlantic and Central U.S.

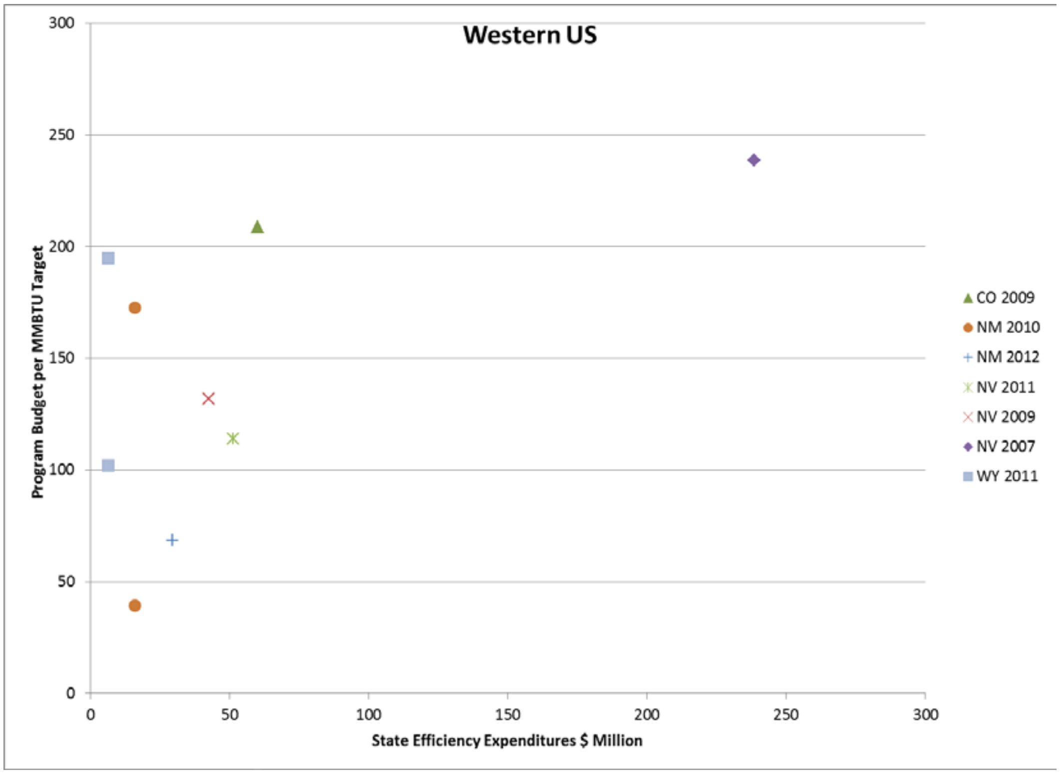

Figure 4 Residential HVAC Budget Rate vs. State Spending in the Western U.S.

Where possible in the data, reported program expenditures and customer costs for program participation were normalized to savings. Customer cost metrics varied: some utilities report gross equipment and installation costs, some report costs net of incentives (e.g., a program covering 100% of equipment cost might be reported as $0 customer cost). Not all reports clarified the participant cost metrics.

For the available data, customer costs per (gross) unit savings had a positive correlation with utility program expenditures per unit savings, as illustrated in Figure 5 below. The far right outlier reflects a Pennsylvania program with no customer costs recorded; the data point with highest customer costs corresponds to the 2011 PECO Energy Company Smart Home Rebates program, which was a multi-end use program.

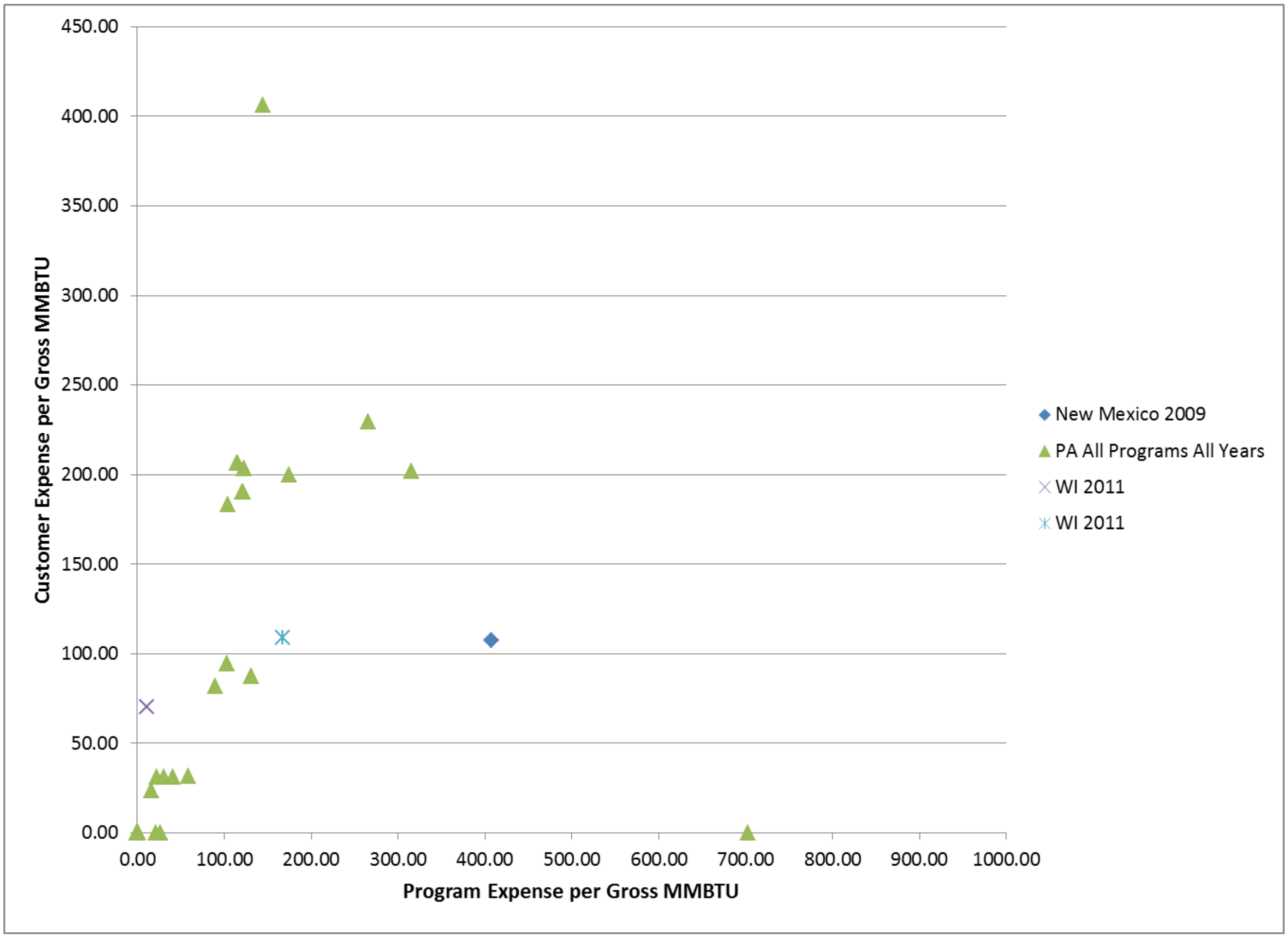

Figure 5 HVAC Participant Costs vs. Utility Program Expense, per Gross MMBTU Saved

Data from residential programs in Pennsylvania and Wisconsin from 2010 to 2012 were available to estimate program participant costs per program gross and verified savings. While the data were not definitive, multi-measure program data shown in **Figure 7** suggested Wisconsin customers spent slightly more per MMBTU saved than Pennsylvania customers in similar programs. In HVAC-specific programs in Pennsylvania, the western-most utility in the state (West Penn Power) had considerably lower reported customer cost rates than the other Pennsylvania utilities (**Figure 6**). Reported participant costs among Pennsylvania utilities are defined as net participant costs equivalent to the cost for the end use customer, while the Wisconsin participant cost data was defined as “incremental measure cost”.

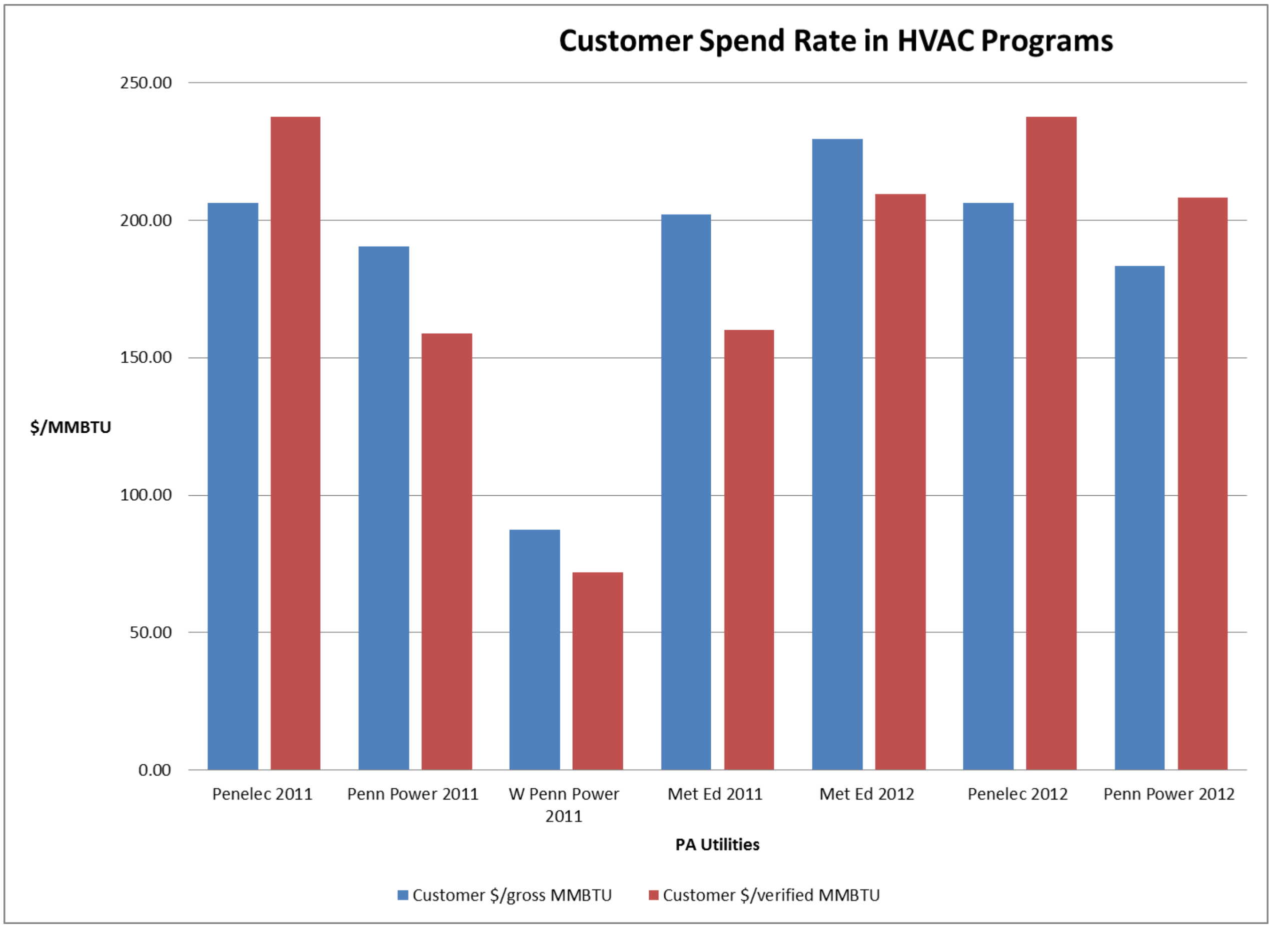

Figure 6 Comparing Residential HVAC Participant Cost Rates

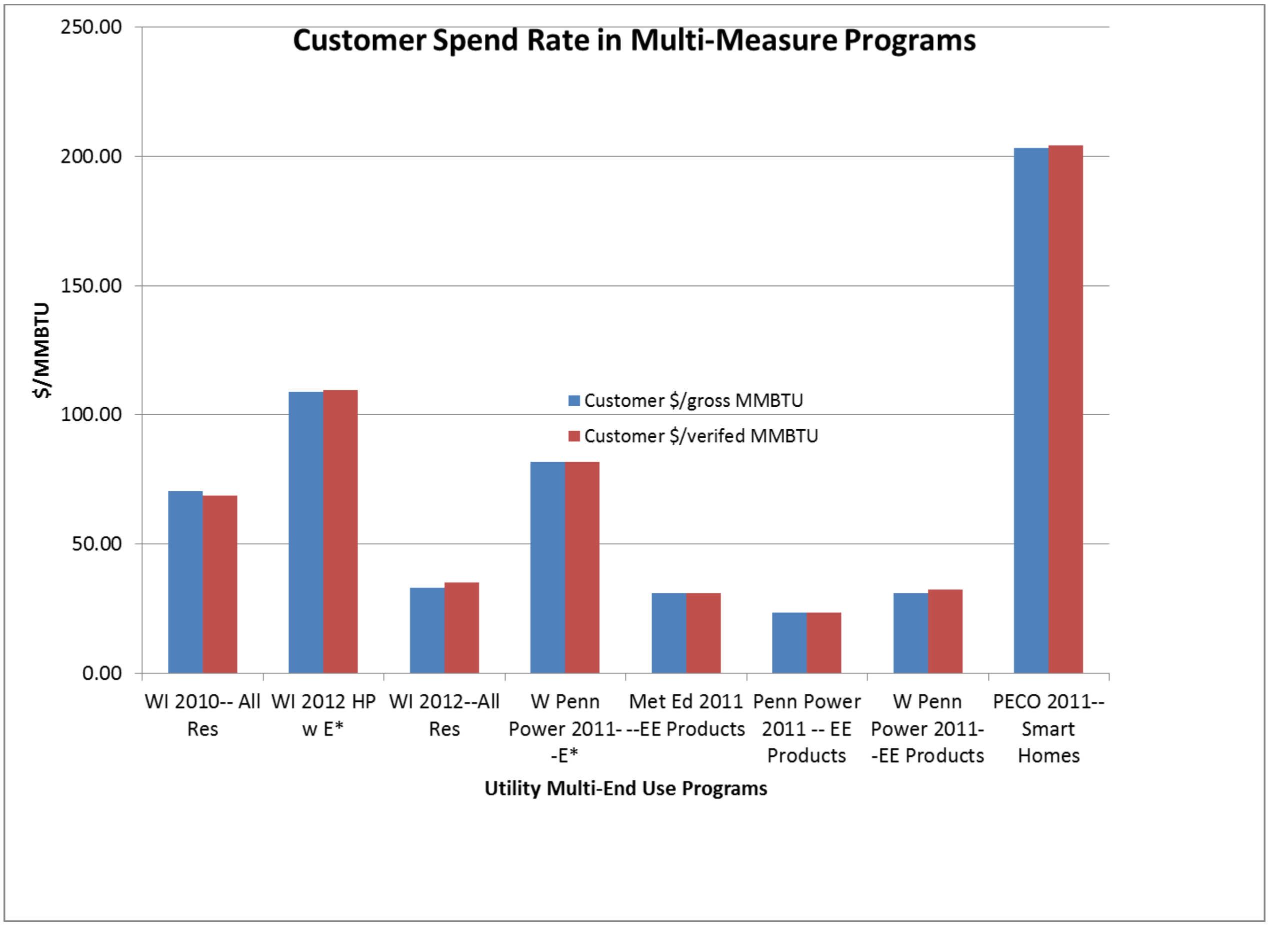

Figure 7 Comparing Residential Multi-Measure Participant Cost Rates

Commercial and Industrial Lighting

Only Colorado and New Mexico program annual reports for 2008 were found to contain participant cost at the measure unit level. Xcel Energy utility reports reviewed for these two states included prescriptive measure assumptions governing savings. The unit costs assumed in these programs, defined as the full measure cost, are shown in **Table 2** below.

Lighting Fixture	CO $/unit	NM $/unit
4' T8 replacing T12, 1 lamp	41.45	32
4' T8 replacing T12, 2 lamp	43.45	32
4' T8 replacing T12, 3 lamp	53.45	56
4' T8 replacing T12, 4 lamp	56.45	56
Highbay T8, 6-8 lamp	N/A	265
T5HO fixture, 2 lamps	192.88	N/A
T5HO fixture, 3 lamps	222.17	N/A
Hardwired CFL<19 W	N/A	50
Hardwired CFL 19-32 W	79.37	57
Hardwired CFL>32 W	N/A	95
150-175 W Pulse Start Metal	161	173
320 W Pulse Start Metal Hali	283	180
750 W Pulse Start Metal Hali	381	180

Table 2 Commercial and Industrial Lighting Unit Cost Comparison

Program spending, energy savings, and budgets data were generally more available among the reviewed utility reports for commercial and industrial lighting programs and measures, than for residential space cooling. **Figures 8 and 9** below compare total state efficiency expenditures to utility commercial and industrial (C&I) sector budgets per unit expected savings. As for residential space cooling measures, utilities offered incentives to commercial and industrial customers through multiple program paths. Different programs may target different segments of the C&I market; or a given customer may be able to pursue a prescriptive unit incentive or a custom or whole-building type program covering multiple end uses.

The program data associated with lighting-specific programs appear to show some negative correlation between total state spending and planned program budget rates. Utilities in states spending more overall on energy efficiency had lower planned spending per unit savings. The New Mexico utility data suggest a yearly drop in planned program spending per million BTU saved, while Oklahoma budget rates stayed fairly flat as state spending in Oklahoma increased.

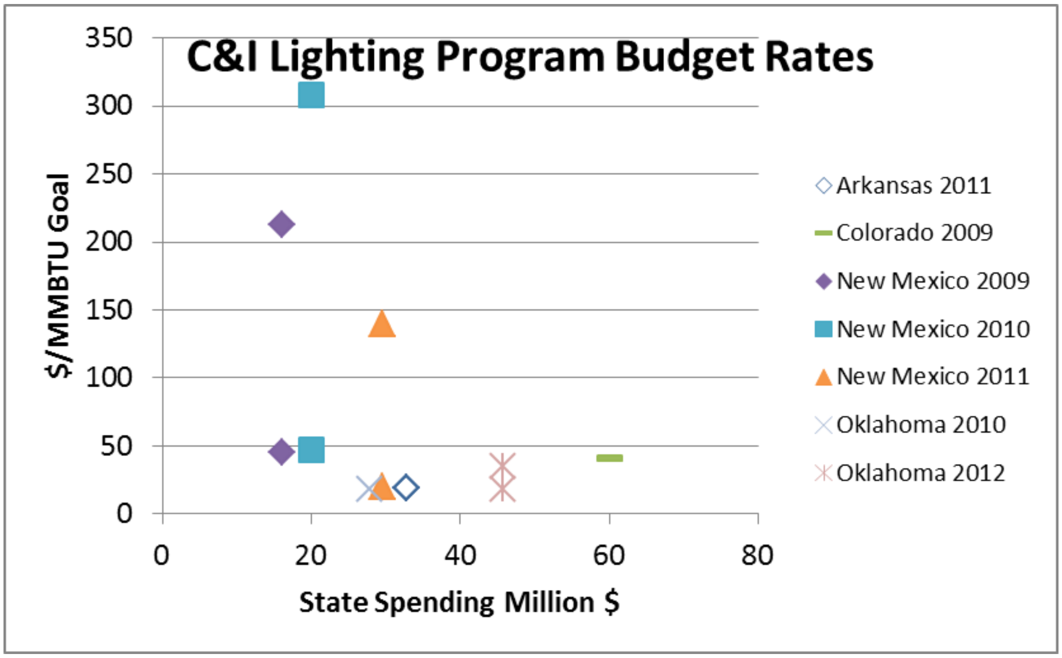

Figure 8 C&I Lighting Program Budgets vs. State Efficiency Spending

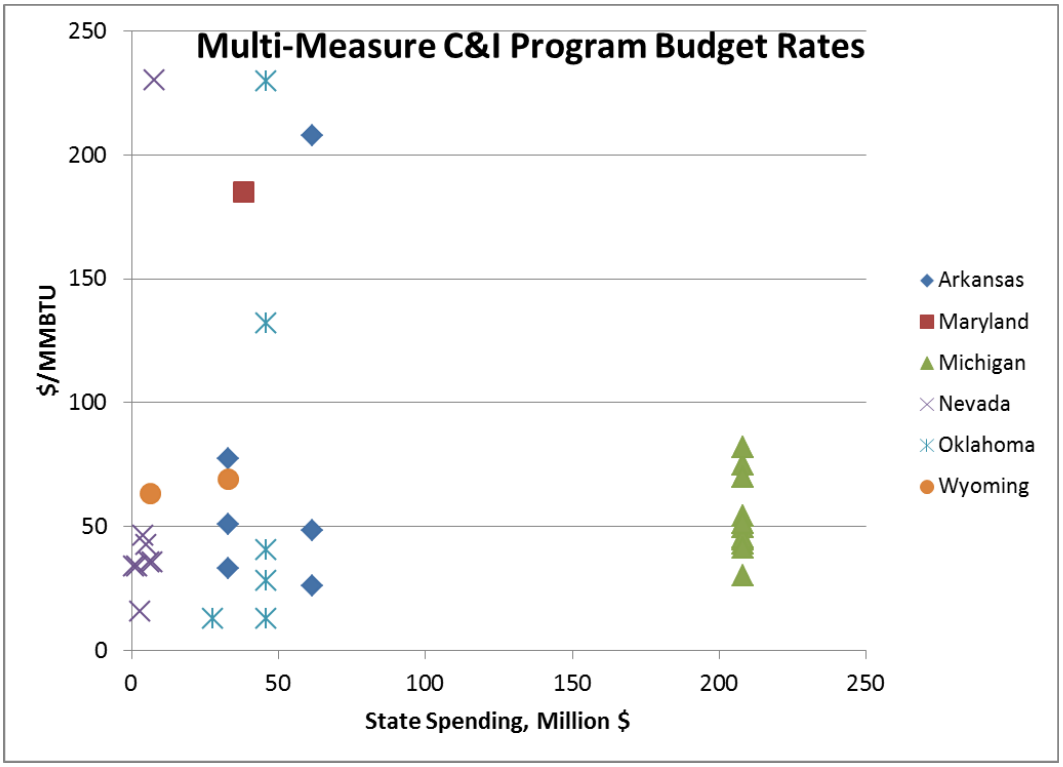

Figure 9 C&I Multi-Measure Program Budgets vs. State Efficiency Spending

While state spending appears to have negative or no influence on program budget rates, available data on actual expenditures per unit savings suggest there may be a positive relationship between utility program spending and customer project spending (**Figure 10**).

Lighting efficiency improvements generally have the most attractive financial paybacks of many building efficiency upgrade options, even without utility program funding. More utility incentive program spending for commercial and industrial lighting may drive customers to spend more (net of incentive) for higher performing or longer lasting equipment, than they would have in absence of the program.

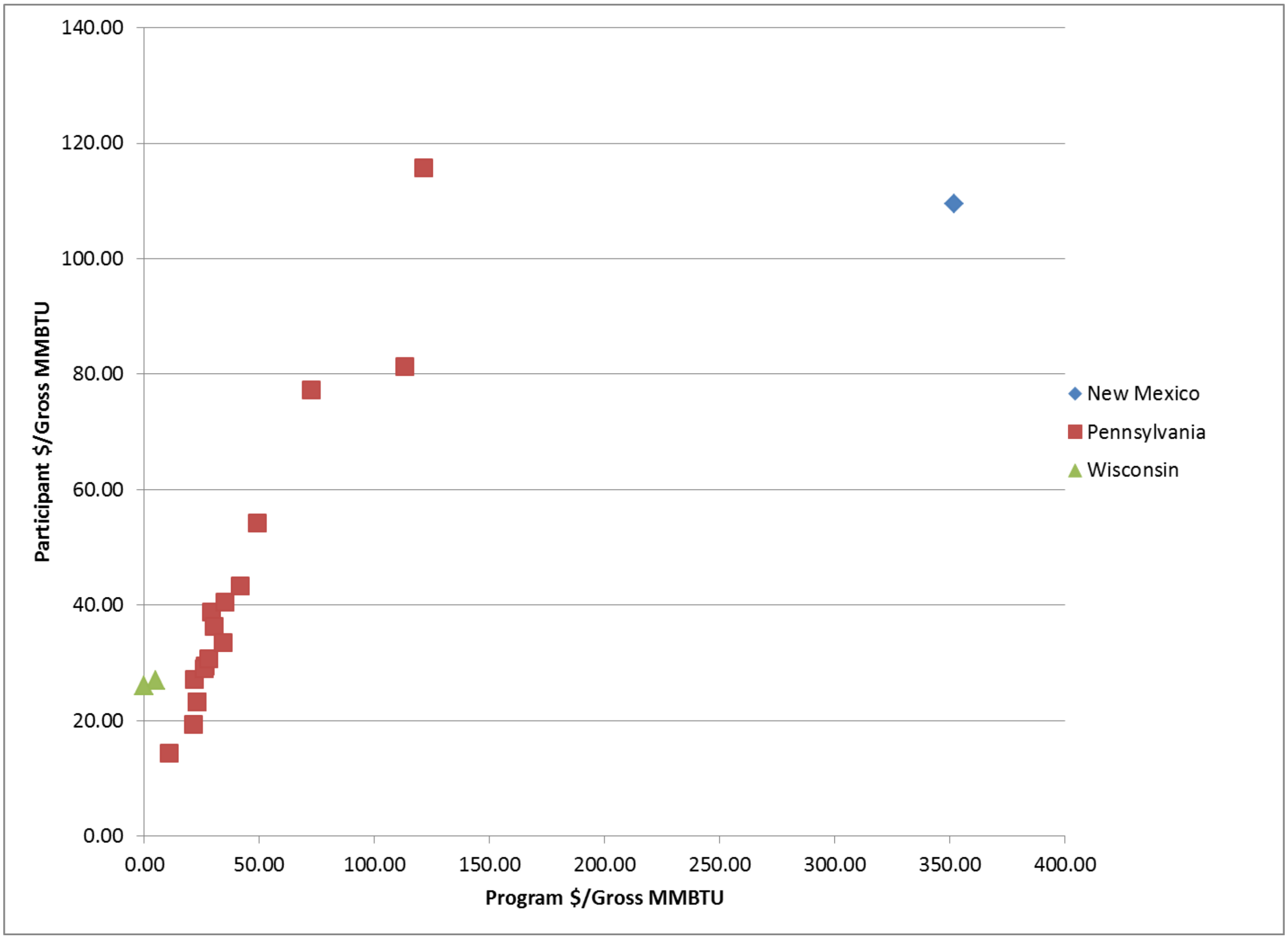

Figure 10 C&I Lighting and Multi-Measure Participant Costs vs. Utility Program Expenses, per Gross MMBTU Saved

Normative Analysis of Efficiency Program Data

The efficiency program data collected covered publicly-available program reports in the majority of U.S. states. However, types and quantities of data available from individual utilities and programs were highly variable, and measure cost distributions throughout the U.S. could not be determined conclusively.

Data Collection and Analysis

An ideal data set for both informing the National Energy Modeling System efficient building equipment demand model, and investigating the possible influence of efficiency programs on market prices for that equipment, would include more detail on technical specifications, application data, and program history. This type of data is often collected during incentive processing and program performance tracking, or estimated in program planning, but rarely reported to regulatory agencies or stakeholders. There are many aspects of program implementation and evaluation that would make such a data set prohibitive. For example:

- Implementation contractors responsible for public and investor owned-utility data tracking and reporting are often subject to competitive bid for a given program cycle; a newly hired contractor may not have full access to past program data, to maintain longitudinal records.
- Prescriptive equipment specifications in program databases are often limited to information that confirms technical eligibility and energy savings. While other data may exist, it may not be readily accessible.
- Program evaluation reports are often driven by regulatory requirements for independent vetting of utility program performance. While regulatory requirements can include verification of standard cost-effectiveness metrics such as Total Resource Cost or the Program Administrator Cost Test, these metrics are rarely required or supported at the measure level.
- Vendor participants and customers may view their equipment cost details as proprietary or sensitive data and refuse permission to publish.

Still, analysis of energy efficiency program data and their link to observed market conditions is not new. Kaufman and Palmer (2010)[2] have used non-parametric statistical tests to determine if significant differences exist between ex ante (e.g. prior to evaluation) savings estimates, evaluated savings estimates, and utility reported savings. Given a complete set of efficiency equipment cost data, a similar test might demonstrate that cost data from one utility or state is significantly different from another utility or state. They also regressed a number of independent variables to determine what differentiates a successful energy program from an unsuccessful program, where the dependent variable was the evaluated realization rate and the independent variables included EM&V budget, program expenditures and budgets, and total program costs (lifetime including participant costs).

In another form of regression analysis, housing market data was used to analyze the influence of energy efficiency certifications on sale prices. A hedonic price model function accounting for vintage, certifications such as ENERGY STAR, building characteristics; temporal/seasonal price impacts; and zip code was developed[3].

A hedonic price model for advanced efficiency equipment, accounting for program availability or rebate amount, weather dependence, vintage, location, and technical characteristics of equipment (such as efficiency of cooling and heating equipment, efficacy of lighting equipment, performance and quality certifications) would require extensive econometric data. The most direct source of this data would be vendor sales records for the utility territories they cover. Vendors sometimes participate directly in incentive programs, or indirectly by assisting their customers with program information and applications; they may reduce equipment invoices when they can collect the incentive, or add costs associated with application assistance.

If a perfect set of equipment data and program data could be compiled, hedonic pricing is known to have its limitations when buyers are not aware that product attributes are linked to product value[4]. In some cases, this may be true for the building equipment market when it comes to recognizing value of efficient equipment vs. standard equipment. In addition, hedonic pricing models assume that buyers can freely choose the product attributes that have the best value for them. In reality, regional equipment variability may be limited.

Alternatively, if utility efficiency program data were consistently defined and reported, simple regression analysis of program and equipment variables could illuminate links between utility program duration and/or spending; evaluation, measurement and verification spending; energy efficiency characteristics; and energy efficient equipment prices. Data should be normalized to unit savings or kW load, and controlled for weather dependence. Linear or non-linear relationships could be tested.

Enhancing Program Reporting

Regulatory and public agencies charged with overseeing utility operations including legislated efficiency initiatives often establish standard data requirements and reporting protocols for their utilities. These standards ensure that key performance indicators are consistently tracked and verified as well as streamline the agency's efforts to review the program outcomes. In addition, diffusion of 'best practices' from early efficiency program adopters such as California has already standardized program criteria and metrics to some extent throughout the program administrator community in the U.S. Multi-stakeholder initiatives such as the SEEAction Network[5] and the Northeast Energy Efficiency Partnerships[6] are consolidating the body of program evaluation, measurement and verification approaches and the data they generate, to build EM&V capacity and consistency throughout the national energy efficiency marketplace. It may benefit regulatory authorities and utilities alike to pursue greater consistency and transparency of energy efficiency program data, not only to streamline evaluation, measurement and verification processes and reduce their cost, but to enhance opportunities for rigorous, external review and analysis of program results[7]. Improved data availability could lead to new understanding or usability of this data for future program and overall energy efficiency planning.

While these benefits are clear, several issues must be addressed in order to overcome data and reporting limitations that have been illustrated to some extent in this analysis:

Issue: Mandatory and voluntary energy efficiency program (impact evaluation) reports are primarily focused on showing performance relative to savings goals set to address customer segments or classes. The performance of the program is then tied to the revenues and costs associated with those segments and classes.

When subjected to mandatory or voluntary efficiency program participation, a utility is obligated to support a rate case and/or meet energy conservation goals by customer sector or customer class, therefore performance reporting is often restricted to this level. In fact, utilities may differentiate incentive offers among customer segments—e.g. a large customer may get more incentive for a unit of savings than a small customer or a government customer, because the large customer pays a higher utility rate. Conversely, a utility may increase incentives for a hard to reach customer segment, such as the public sector. Reporting savings and costs at the measure level would increase data tracking requirements as well as invite comparisons among measure offerings.

Normative Analysis Point: Utilities may see benefits if they expand the objectives of program reporting to align with future program planning needs or to address public interests. In one example, possible crediting of energy efficiency program impacts for future state or federal clean energy standards or greenhouse gas regulations would rely on consistent data collection and verification of measure level energy savings data. Also, some states allow interstate trading of energy savings credits to meet their EERS or RES requirements, when those energy savings can be clearly and consistently verified. A more standardized reporting format and data definitions would enhance the credibility of all programs and their energy savings claims.

Utilities are not the only entities operating programs; many states are now operating programs and contracting out to public or private entities. Collecting and reporting data at the measure (and program) level can provide important information to continually assess the selection and implementation of new or improved technologies and adjust incentive levels to improve energy efficiency programs.

Issue: Program EM&V emphasis may be on proving the newest offerings, rather than following performance of 'mainstream' efficiency measures.

Where EM&V activities are budget-limited, voluntary, and/or stretched among a broad spectrum of new and mature programs, or where regional or national-level EM&V is conducted[8], there may be greater interest in emerging efficiency offerings and programs than in ongoing analysis of prevalent offerings such as efficient lighting or HVAC. While this focus supports the continued advancement of the energy efficiency 'frontier' and adoption of new and innovative efficiency offerings, it may stall data collection and updated analysis that could inform building equipment policies and markets. As a result, measure level data for this equipment may be 'recycled' from other sources for technical verification of savings, rather than updated per measured findings.

Normative Analysis Point: Ongoing collection and analysis of measure data for typical building systems such as lighting and HVAC could highlight market conditions and trends that would be useful for future program planning as well as regional or state efficiency policies.

Some state Technical Reference Manuals for efficiency measure savings estimation update their deemed unit savings regularly, based on EM&V results.

Issue: Despite some standardization due to regulations and best practices, program report methods and data vary by utility and state.

1. Reported savings metrics are increasingly presented in a spectrum that spans from ex ante gross to verified net savings. The methods and assumptions behind any metric in that spectrum can vary. For example, one state's ex ante unit savings for a lighting fixture may be based on the previous year's verified savings; another state's ex ante unit savings may be based on generalized engineering assumptions. In addition, program reports can include unadjusted ex ante savings from the implementation contractor; verified savings with installation rate adjustment only, technical adjustment only (seen in one set of reports as ex poste gross); or both, and/or net savings with technical adjustment plus free rider/spillover attribution. Some program administrators may derive net to gross assumptions based on market surveys; some may assume other net to gross study values; some may not apply net to gross analysis. Other analytical efforts have noted that in state level data, reported savings are ambiguous as to net or gross accounting[9].

Normative Analysis Point: savings metrics could be more clearly defined and standardized, as suggested below and by :

- Ex ante savings=unadjusted program implementation data;
- Gross savings= pre-EM&V savings recorded for or by the EM&V contractor (it is possible that this number could differ from ex ante);
- Verified savings=gross savings adjusted for install rates;
- Technical verified savings=gross savings adjusted for install rates and engineering review results;
- Net verified savings=gross savings adjusted for install rates, engineering review results, and spillover/free ridership.

Consistency may improve stakeholder trust in results and improve usability of data for future program planning.

2. Program data may or may not include participants (and participation may be in units of equipment, applications processed, or customers). Participant data found in the program reports for this analysis were largely not well defined.

Normative Analysis Point: consistent participation definitions will improve usability of data for future program planning. In order to translate the results of an energy saving program to another customer segment or another region, it is important to understand the basis for program uptake.

3. Program annual report or EM&V report data may include budgets, expenditures, both, or neither. Where reports include cost-effectiveness metrics, these metrics are usually set at the program or portfolio level.

   Normative Analysis Point: EM&V contractors may not have direct access to budgets or expenditures, but they often are asked to calculate cost effectiveness of programs, especially for annual regulatory reports. Adding a summary of program budgets and/or expenditures would make cost/benefit analysis more meaningful to the stakeholders and broaden the definition of program performance.

4. Measure units may vary and lack definition in the report. For example, a report on the performance of an HVAC program may define an HVAC measure in tons or heat rate capacity, or as unit equipment of assumed and/or unknown specifications. In addition, an HVAC measure defined in cooling tons may have the incentive defined per kWh saved.

   Normative Analysis Point: Clearly defined units may help stakeholders better understand report results and contents

5. Many utilities are likely collecting cost quotes from customers, or estimating costs themselves, in order to verify the cost-effectiveness and equity of program expenditures. However data records that could be available for reporting may be subject to program criteria. Incremental or total costs may be collected; labor and/or operations and maintenance may be included or not. Program administrators may use deemed measure costs from technical reference manuals or get estimates.

Normative Analysis Point: In general, the definitions of measure or project costs are well understood and could be clarified consistently with defined sources.

Issue: Reporting requirements are often dictated by the state commission or other oversight agency, as stated in issue 1. While this facilitates standardization, it may also be the cause of data restrictions. Reporting requirements may prohibit or deter additional data reporting, for ease of regulatory use. In addition, program administrators may often prescribe to the 'answer the mail' approach to reporting; more data can be associated with more opportunities to expose errors or uncertainties that may detract from performance points.

Normative Analysis Point: An umbrella organization could coordinate with regulatory agencies and public service commissions to develop data collection and reporting requirements and processes that will minimize confusion in performance assessment and promote additional data sharing. The EM&V Working Group of the State & Local Energy Efficiency Action Network[10] may already have similar objectives.

Sample data provision (e.g. measure costs from a few projects in a given program), rather than census reporting, could forestall excessive scrutiny on data quality while illustrating the assumptions and market conditions behind program measures.

Issue: Evaluation, measurement and verification reports may cover multiple program years at once, or a single program year. Utilities may only conduct an evaluation on part of their portfolio at a time. Disparate time frames can make comparison of data difficult.

Normative Analysis Point: Due to increasing legislation at the state level requiring energy conservation plans and progress toward plans on the part of regulated utilities, annual performance analysis and reporting will likely become a standard.

Issue: EM&V reports discuss impacts of federal standards change, codes change, and market conditions, which could influence reported savings and costs, in the narrative, but it can be difficult to link such changes and conditions to quantitative EM&V results.

Normative Analysis Point: EM&V contractors take standards and code into account when completing measurement and verification activities. Incorporating semi-quantitative data into a program performance matrix, such as a yes/no indicator of code change in the reporting period, could more directly illustrate the influence of such market effects on the program or measure-level performance.

These issues are a sample of the variability that arises among energy efficiency program evaluation, measurement and verification reports and results, limiting their application for broader, independent investigation of the impacts of such programs to the U.S. energy market. However, these are not new to the program administration and the evaluation, measurement and verification communities. As state legislation of energy resource planning and energy conservation advances from a new phenomenon to standard practice across the U.S., interest in comparing these programs and the markets they operate in may drive regulators, administrators and evaluators to find solutions for these issues.

Conclusions and Recommendations

This task has illustrated the inconsistency of publicly-available program data from the evaluation, measurement and verification reports of regulated utilities, and the relative lack of reporting on equipment costs. While it has been acknowledged that other sources of measure and program costs may exist in program plans, economic potential studies, and independent measure cost studies, these are less frequently required to be available to the public. The premise of this investigation is that required program evaluation and annual reporting to regulatory authorities could be enhanced with inclusion of data that can illustrate how efficiency programs are affecting the types and markets for building energy systems equipment.

However, inclusion of additional data to be verified at the measure level will likely add costs and complexity to the process of data tracking and reporting as well as evaluation, measurement and verification; and may require changes to rules for regulated program reporting that are in place to minimize the burden to the program administrators.

In addition, many programs are designed in multi-year cycles; changes in program and measure costs on a unit savings basis may be better observed among cycles, rather than year to year. Since electronic submission and storage of program reports is a relatively new option, utilities with multiple program cycles in their history unfortunately may not have multiple cycles' worth of reports readily and electronically available.

However, even the limited residential space cooling and commercial and industrial lighting data associated with program and participant costs in this analysis suggest some trends. When compared to total state expenditures, budgeted costs per unit savings of administering a program among the states appeared fairly flat. Over the span of a few years, this could be caused by program administrators [11]'borrowing' budget rates and program plans from other known programs already implemented in other states.

On the other hand, when compared to program spending per unit savings, not surprisingly reported participant costs per unit savings do seem to have a positive relationship. Increasing program spending might indicate where programs are moving from early, simple prescriptive programs to more complex participation opportunities such as whole building retrofit or new construction programs. More complex and comprehensive program offerings may encourage projects whose costs go beyond efficiency improvements to cover non-energy consumption features of equipment and projects.

In order to continue pursuing program data that could (in the short term) inform the National Energy Modeling System inputs as well as test the relationships between program availability and maturity, and market prices, it is recommended that additional data sources be sought, namely program plans that often include measure lists and assumptions. In the longer term, a national initiative exploring and contributing to existing stakeholder group discussions of improving evaluation, measurement and verification and other regulatory reporting could enhance the resulting program documentation for future research and resource planning.

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