Market Opportunity Analysis for Utility DSM Programs

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ABSTRACT

New and proposed regulations, such as the Green Communities Act in Massachusetts, along with the high cost of new generation, transmission and distribution, and public pressure to provide affordable and reliable energy, are causing electric and natural gas utilities to aggressively develop demand-side management programs. An energy efficiency (EE) potential study is a common first step in this process; however, utilities frequently find a gap between the information in these studies, and that which is needed to develop actionable EE strategies. Through our work with several utilities in the northeast United States, we customized and expanded relevant EE potential studies by: (1) incorporating historic and current EE programming data, (2) pairing utility-specific data with the potential studies' findings, and (3) developing improved customer segmentation. The resulting work culminated in the Energy Efficiency Market Opportunity Analysis (EEMOA) which allows a utility to: (1) assess aggregate data to inform program strategy and resource deployment, (2) use granular data for tactical planning and implementation, (3) discern differences between customer segments and recognize unique marketing techniques required for each, and (4) better defend reported EE budgets and targets to both internal and external stakeholders. Ongoing development of the EEMOA has identified opportunities to enhance output analytics by emphasizing customer-level analysis, program scenario analysis, new and emerging technologies, and additional use of primary market research, thereby providing a more useful framework for delivering the actionable guidance utilities need to develop and implement effective EE programs.

Introduction

When natural gas and electric utilities turn their attention toward improving the efficiency of energy use in their service territories, regional energy efficiency (EE) potential studies are typically a first step. Utilities with a service territory-specific potential analysis may attempt to use the study's findings as the basis from which to build its EE strategy. Unfortunately, utilities frequently find a gap between the information contained in available potential studies, and the information needed to develop actionable EE strategies.

Point380, LLC, a resource efficiency consulting firm, developed the Energy Efficiency Market Opportunity Analysis (EEMOA) in response to utilities' need for enhanced market analytics and utility-specific EE potential study customization. The EEMOA aims to bridge the gap between potential studies and utilities' needs by: (1) incorporating all available data relevant to the utility's current and historic EE programming; (2) pairing this utility-specific data with the potential studies' findings and incorporating additional external data sources as needed in order to develop actionable insights that will allow the utility to quickly develop and implement an EE strategy (or adapt an existing one to better respond to its operating reality); and (3) developing an improved segmentation of the utility's customer base in order to provide an accurate picture of how energy is currently used in the subject territory, and where opportunities for improvement are likely to exist.

The EEMOA is an assessment of a utility's opportunity to implement EE technologies and programs. The EEMOA incorporates utility-specific customer and EE program data, along with detailed external EE market data of the commercial, industrial and residential sectors, as well as the many segments therein. The analysis identifies the most cost effective and highest impact opportunities for EE in a utility's service territory. The results include estimates of the relative market opportunity for EE between the energy market sectors. It provides the utility with additional insight into where to best allocate resources by highlighting differences between customer segments and suggesting unique marketing techniques for each.

Ongoing development of the EEMOA includes additional opportunities and areas for enhanced analyses to serve key stakeholders in the utility: department VPs/managers, program directors, and customer representatives. These include expanded customer-level analysis to improve the ability to prioritize customers based on both energy use intensity and their specific EE opportunities, scenario analysis that allows EE managers to predict program effectiveness, consideration of new technologies, and additional use of primary market research to inform the quantitative analysis (Moezzi 2009). Collectively, this will provide the framework and actionable guidance that utilities need – just as the telecom companies needed after the deregulation of their industry in the 1990s – to better understand their customers, formulate strategy, allocate their EE budgets, and implement effective programs (Hirsh 2012).

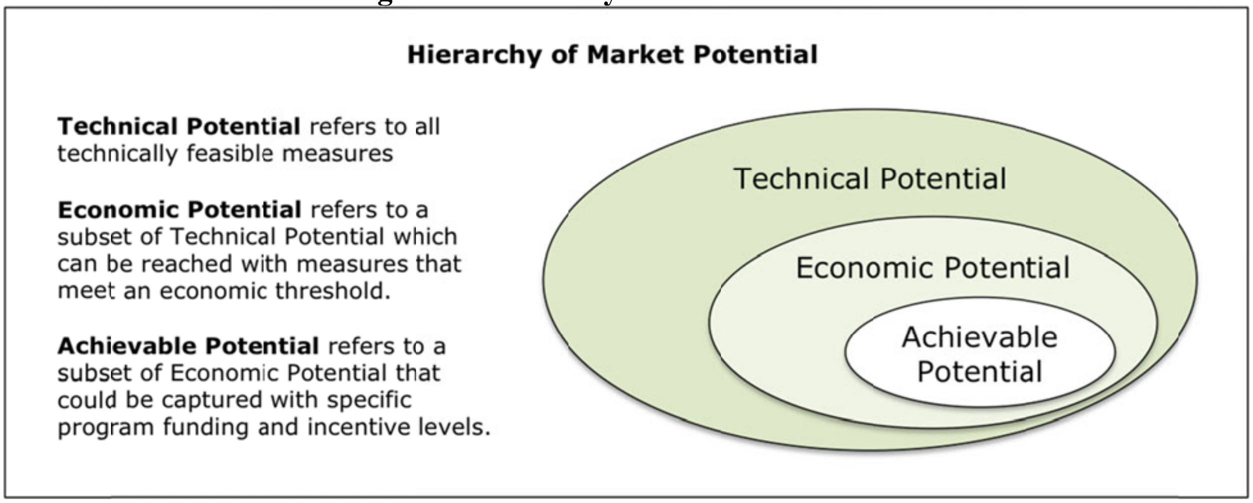
This paper is a description of the EEMOA, its input and output, what it offers beyond a common potential study, and plans for its continued development.

The Limitations of the Standard Potential Study

> *"[Energy efficiency potential studies] are typically the first step taken by entities interested in initiating or expanding a portfolio of efficiency programs, and serve as the analytic basis for efforts to treat energy efficiency as a high-priority resource equivalent with supply-side options" (Mosenthal & Loiter 2007).*

When natural gas and electric utilities turn their attention toward improving the efficiency of energy use in their service territories, regional EE potential studies are typically a first step (Stratton & York 2009). These potential studies may be commissioned anew by the utility itself, or may have been done in the past by another entity (e.g. state or regional group). The input, methodologies, and output of these studies generally follow well-established norms using either top-down or bottom-up approaches to estimate the types of EE potential and associated costs. As depicted in Figure 1 on the following page, these types of potential typically include *technical* (the maximum potential given available technology), *economic* (the subset of technical potential deemed cost-effective), and *achievable* (the subset of economic potential that accounts for real-world barriers to improving EE) (Sreedharan 2009). Certain studies also include variations on achievable potential.

Figure 1. Hierarchy of Market Potential



Utilities with a service territory-specific potential analysis may attempt to use the study's findings as the basis from which to build its EE strategy. Unfortunately, utilities frequently find a gap between the information contained in available potential studies and the information needed to develop actionable EE. This gap is primarily due to three factors: (1) a mismatch between the objectives of the potential study and the needs of the utility's EE programming, (2) a lack of consideration of current and historic utility EE program implementation (Kramer & Reed 2012), and (3) reliance on a simplistic and/or inaccurate system for segmenting the utility's customers (Stratton & York 2009).

First, many potential studies' primary aim is to quantify and describe the EE potential within a given region. For instance, the motivation behind this may be to compare EE with supply side alternatives on equal bases (EES 2010), or to develop data for the consideration of a policy change (DoE 2006). The utility, on the other hand, requires more actionable data to successfully realize gains in EE – that is to say, a utility needs to know not only what the EE potential is, but exactly where it is, how to target it, how much to budget to achieve it, and what EE gains it might expect for a specific time period. Traditional potential studies often fall short of these needs.

Second, most utilities today are not new to the practice of EE programming. Rather, they have run programs across their customer bases for many years with varying levels of success and insight gained, and a range of measure penetrations. These results are highly specific to a particular utility and cannot be accurately generalized across service territories. Regardless of the accuracy and regional applicability of a potential study, a utility's past experience with its EE programming has a significant impact on: (1) how much EE of a given type remains in its customer base; (2) what costs, particularly non-incentive costs, such as administrative costs, the utility should budget for; and (3) at what rate the utility can expect to realize future gains in EE via either the continuation of existing programs or the creation of new ones (Hopper et al. 2008).

The final component of the gap is due to potential studies' tendency to consider a utility's customer base in only high-level, generalized classifications, such as sector (e.g. commercial, industrial), or generic segment (e.g. office, school), thereby missing valuable insights that the utility's EE programming staff might use to target customers for EE improvements. Specifically, customers should be segmented as finely as possible using data such as NAICS code, energy use intensity (e.g. energy consumption per sq.ft.), and customer size (e.g. annual energy consumption or peak demand), to give the utility the highest possible resolution of how energy is used as a baseline, and what types of EE measures are most applicable to each segment (Hurtado. 2010).

The EEMOA: Expanding and Customizing the Potential Study

The Green Communities Act, passed in the Commonwealth of Massachusetts in 2008, requires the electric and natural gas utilities in that state to pursue "…all available energy efficiency and demand reduction resources that are cost effective or less expensive than supply" (Cwlth of MA 2008). At the time the new law was enacted, what this meant in practice was unclear. Though EE potential studies were available and a good place to start, they did not offer sufficient utility–specific information, effectively account for EE already realized through current and historic utility EE programs, consider varying utility cost and incentive structures, or provide insight into how to allocate the increasing EE budgets the law was now requiring.

To meet the requirements of the Green Communities Act, Point380 was contracted by one of the major Massachusetts utilities to expand upon the potential study and develop a client-focused market analysis that:

- Reported the relative opportunity for EE for each segment of the utility's customer base;
- Took into account EE measure implementation achieved by the utility's current and historic EE programming;
- Incorporated the time-dynamic of implementation in the form of estimated EE measure and program ramp-up rates;
- Provided a means to filter EE measures based on their current and long-term economic viability;
- Employed primary market research to understand and characterize barriers to utility-sponsored efficiency programs;
- Produced detailed customer segmentation for customer-tailored program marketing and service offerings.

The resulting work, and subsequent work Point380 has performed with electric and natural gas utilities in twelve service territories throughout Massachusetts, Rhode Island, and New York, has culminated in the development of the EEMOA. The EEMOA aims to bridge the gap between potential studies and utilities' needs by allowing a utility to: (1) assess aggregate data to inform program strategy and resource deployment; (2) review granular data for tactical planning and implementation; (3) discern differences between customer segments and recognize unique marketing techniques required for each; and (4) better defend their reported EE budgets and targets. In addition, the EEMOA provides the utility with analyses specific to their service territories that incorporate more accurate baselines, and economic and geographic factors.

The EEMOA is a high-level, forward-looking projection of EE program opportunities and market prioritization assessments based on EE market opportunity delineated by market sector, customer segment, energy end-use, and EE measure. It is a data analysis of utility-specific customer data, current and historic EE program data, along with external EE market data and industry information. The analysis provides estimates of the relative market opportunity for EE between the energy market sectors, and provides the utility with additional insight into how to best allocate resources.

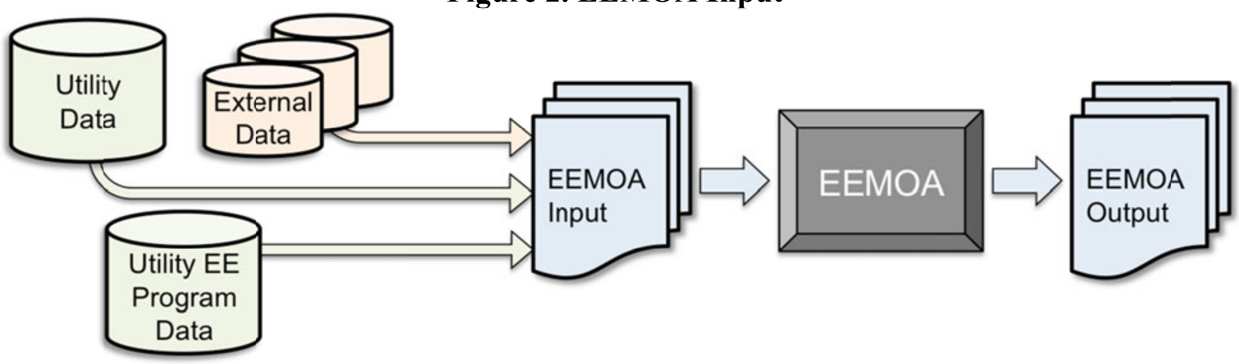
The Analysis

The EEMOA is an assessment of a utility's opportunity to implement EE technologies and programs. The EEMOA incorporates utility-specific customer and EE program data, along with detailed external EE market data of the commercial, industrial and residential sectors, as well as the many segments therein. The analysis identifies the most cost effective and highest impact opportunities for EE in a utility's service territory (Swisher, Jannuzzi & Redlinger 1997). It provides the utility with additional insight into where to best allocate resources by highlighting differences between customer segments and suggesting unique marketing techniques for each.

Market Opportunity Analysis Input

The EEMOA incorporates three data sets each of which is crucial to the analysis: Utility Data, Utility EE Program Data, and External Data (Figure 2). A significant portion of this data is generated by the utility itself, while supplemental industry and regional data are gathered by the analysts. This ensures that the EEMOA is as accurate and territory-specific as possible for the given utility, including more accurate baselines, and economic and geographic factors.

Figure 2. EEMOA Input



Utility data. These data include energy consumption, building and industry type designations, and NAICS codes used for segmentation first by sector (i.e. commercial, industrial, and residential) and then by segment (e.g. small office, electronics manufacturing, single-family residences). Other data in this grouping include high-level data such as the utility's system consumption and demand by sector, which includes projections for these values forecasted several years into the future. Values used to calculate the utility's avoided costs are also gathered and analyzed.

These data are used to establish a baseline for how energy is consumed within the utility's territory, and then customize and refine the EEMOA to better reflect the study utility's customer base.

Utility EE program data. The EEMOA uses Utility EE Program Data in conjunction with the Utility Data and External Data in several ways. Historic EE program implementation data is collected and analyzed with regard to its impact on historic EE savings, expectations for current and future market EE opportunity, program and technology efficacy, and technology saturation and adoption rates. This includes analyzing program metrics such as the number of customers reached by each program, percentage of customers using EE programs to make upgrades, the types of upgrades and measures implemented, estimated energy saved through implementation, and valuation of program cost.

Detailed measure-level data includes descriptions of the EE measures offered, the estimated energy and demand savings (both in aggregate and by measure) and technology costs. These data are paired with utility-specific data, such as energy consumption forecasts, building stock breakdown, and program administration costs. The result is that the EEMOA can translate the utility's technical and economic EE potential into much more relevant output, including estimates of how the running of EE programs will affect consumption and load forecasts. Additionally, these data offer insight into a range of variables such as the effects of the incentive level for a given EE technology applied to a given customer segment, and what this may suggest for future program performance.

Thorough evaluation and integration of Utility EE Program Data make possible better-informed estimates of the rate at which the utility could expect to realize EE potential in its territory, by measure, segment, and sector, through EE programs.

External data. External Data is used to provide the framework and methodology for the EE opportunity estimates, and to include information that may not have been available from the utility. High-level External Data collected includes energy use within the utility territory, delineated first by segment (e.g. energy use, building type), then by energy end-use (e.g. lighting, HVAC, refrigeration). External Data also includes detail on EE measures and their applicability across a range of customer segments. Additionally, external sources may be used to fill in gaps in critical data such as avoided cost data, peak coincidence of savings due to EE measures, and energy usage patterns such as consumption by energy end-use for a particular segment.

Sources of External Data used vary by utility, but include the U.S. Energy Information Administration's Commercial Energy Consumption Survey, the California Energy Commission's Commercial End Use Survey and Residential Appliance Saturation Survey, and various EE potential studies performed by the New York State Energy Research & Development Authority, as well as others.

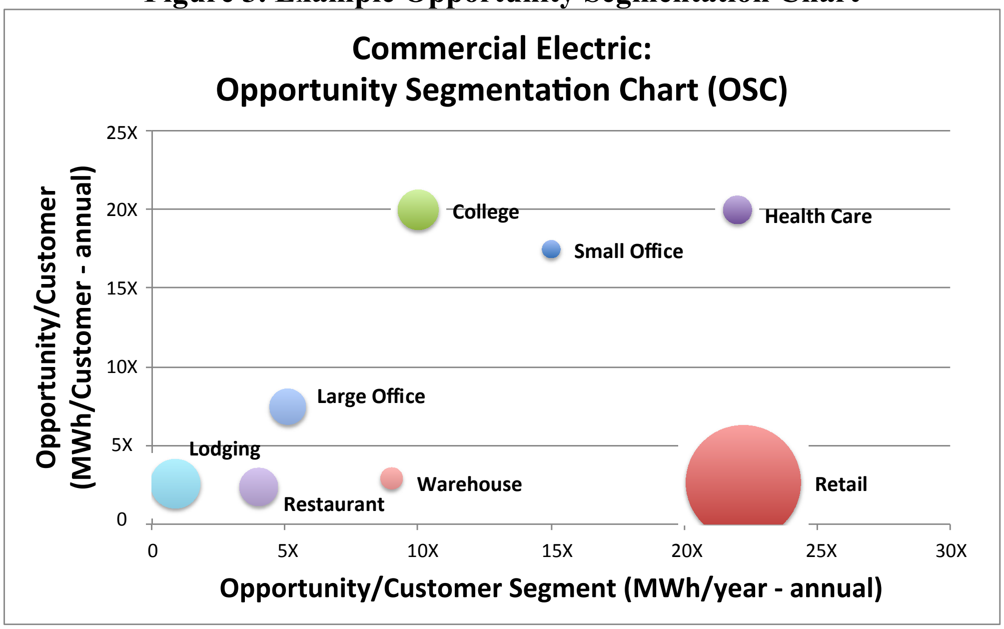
EEMOA Output

As parts of the EEMOA, Point380 developed a series of analytical and graphical tools to quickly and clearly demonstrate results of the analysis. These include the Opportunity Segmentation Chart (OSC), the Cost Effectiveness Table (CET), and the Measure Effectiveness Table (MET), each of which is described below.

Opportunity segmentation chart (OSC). The OSC (Figure 3) provides a graphical depiction of the relative market opportunity for each customer segment based on total energy savings opportunity, savings opportunity per customer, and the number of customers in specific customer segments. The OSC independently presents electricity and natural gas services, as well as commercial, industrial and residential sectors. In addition, the OSC can present combinations of these energy services and sectors collectively on a single chart.

The x-axis of the OSC represents the total savings opportunity for each customer segment; the y-axis represents the savings opportunity per customer for each segment; the bubble size represents the total number of customers in a given segment.

Figure 3. Example Opportunity Segmentation Chart



The relative position of a customer segment on the chart might suggest a particular approach to program design and customer engagement. For example, a relatively small Health Care segment in the upper right quadrant of the chart would denote both a large total EE opportunity for that segment as well as a large EE opportunity per customer. This might suggest targeting the Health Care segment with customer representatives as opposed to a mass marking effort. As another example, a relatively large Retail segment in the lower right quadrant might suggest a broader marketing and outreach campaign (i.e. mass marketing). A utility may put a low priority on a segment in the lower left quadrant, given its combination of small total EE opportunity and small opportunity per customer.

Cost effectiveness table (CET). The CET (Figure 4) enables quick identification of the customer segment/energy end-use combinations that offer the least expensive EE. Adding to that identification are red shaded cells, which indicate the "top 10" most cost effective customer segments/energy end-uses (i.e. "biggest bang for the buck"). To the extent possible, the cost analysis represents the total system costs. That is, cost data includes the cost of the EE measure (technology), the program administration costs and the customer rebate (incentive) costs as a fraction of the full measure cost. The measure cost takes into account whether it is a retrofit measure (only the incremental cost above the baseline measure is counted), or a replace-on-burnout measure (full cost is counted).

Figure 4. Example Cost Effectiveness Table

Cost per kWh Savings (lifetime)					
End Use -->	Cook	HVAC	Lights	Miscellaneous	Refrigeration
Small Office	-	$0.072	$0.046	$0.032	-
Retail	$0.081	$0.064	$0.047	$0.031	-
Health	$0.072	$0.045	$0.044	$0.031	-
Miscellaneous	$0.055	$0.090	$0.045	$0.031	-
Grocery	$0.055	$0.083	$0.040	$0.029	$0.030
College	$0.080	$0.037	$0.065	$0.031	-
School	$0.055	$0.077	$0.045	$0.028	-
Warehouse	-	$0.067	$0.050	$0.030	-
Large Office	$0.086	$0.041	$0.047	$0.035	-
Restaurant	$0.063	$0.056	$0.054	$0.037	$0.046
Lodging	$0.068	$0.035	$0.048	$0.028	-
Ref. Warehouse	-	$0.085	$0.056	$0.029	$0.024

Measure effectiveness table (MET). The MET (Figure 5) enables quick identification of the customer segment/energy end-use combinations that offer the largest relative EE opportunity. Further, red shaded cells indicate the "top 10" customer segments/energy end-use contributors to total sector EE opportunity (i.e. largest opportunity). Viewed as a topographical map, of sorts, the peaks (i.e. largest percentages) show both the measure categories and customer segments that provide the greatest contribution to the sector's total EE market opportunity. For example, if the total commercial sector EE market opportunity equals 100 MWh, then this table would indicate that 9 percent of that total EE opportunity, or 9 MWh, can be achieved from Small Office lighting measures.

Figure 5. Example Measure Effectiveness Table

Savings % of Total Savings Opportunity						
End Use -->	Cook	HVAC	Lights	Miscellaneous	Refrigeration	Total
Small Office	-	8%	9%	1%	-	18%
Retail	0%	8%	6%	1%	-	15%
Health	0%	4%	9%	1%	-	14%
Miscellaneous	0%	0%	1%	0%	-	1%
Grocery	0%	1%	1%	0%	20%	22%
College	0%	7%	7%	0%	-	14%
School	0%	2%	3%	0%	-	5%
Warehouse	-	1%	3%	0%	-	4%
Large Office	0%	1%	2%	0%	-	4%
Restaurant	0%	1%	0%	0%	1%	4%
Lodging	0%	0%	0%	0%	-	1%
Ref. Warehouse	-	0%	0%	0%	0%	0%
Total	0%	33%	41%	4%	22%	100%

Coupled with current and historic utility EE program data, the MET aids in the evaluation of a utility's past performance against the EEMOA's estimate of EE market opportunity. It provides insight into the customer segments/energy end-uses that are underserved or underperforming, as well as those in which significant EE improvements have already been achieved.

Continued Development

The ongoing development of the EEMOA has identified additional opportunities and areas for enhanced analyses, including expanded output analytics to better serve key stakeholders in the utility: department VPs/managers, program directors, and customer representatives. This includes expanded customer-level analysis to improve prioritization of customers based on both energy use intensity and their specific EE opportunities, scenario analysis that allows EE managers to predict program effectiveness, consideration of new and emerging technologies, and additional use of primary market research to inform the quantitative analysis.

Energy Efficiency Market Intelligence Report

Developed for the department VP/manager, the Energy Efficiency Market Intelligence Report delivers a high-level summary of the EEMOA output coupled with a review of applicable industry best practices, leading market insights and best-in-class EE programs. From this, department VPs/managers will have actionable data with which to prioritize the deployment of resources, view the EE program opportunities within their utility's territory, and compare their utility's programs and practices to other utilities and to the industry as a whole.

Predictive Program Performance

The Predictive Program Performance analysis is geared towards program directors – those charged with the development and implementation of a utility's energy efficiency programs. This considers the efficacy of the utility's historic EE programs, macroeconomic data and trends, and the development and commercialization of new and emerging technology. In addition, the use of targeted, utility-specific primary market research will improve the understanding of common barriers to utility-sponsored efficiency programs, and will act as an important input in the quantitative analysis (Moezzi 2009). The analysis will enable the comparison of programming scenarios to improve barrier assessment, inform program design and better predict program effectiveness.

Customer Level Analytics

Developing Customer Level Analytics begins with improved data entry and collection, including ensuring data consistency among programs both current and historic. This analysis also requires incorporating additional data to improve EEMOA accuracy, such as detailed building data (e.g. square footage, age, tenant- v. owner-occupied), localized EE measure data, and weather-normalized annual comparisons (Energy Data 2013). The result are output analytics that: (1) identify EE opportunities on a customer level rather than just a generic segment level, (2) provide customer prioritization tools and resources to expand and accelerate program implementation, and (3) provide a framework to measure and track program progress on an ongoing basis.

Summary

By expanding and customizing the traditional potential study, the EEMOA allows utilities to access information that helps them develop program strategy, discern differences between customer segments, recognize unique marketing techniques for each, better inform and defend their reported EE targets, and more effectively reach their customer base with EE programs. Ongoing development of the EEMOA is providing a more informative and useful analytic framework to deliver the actionable guidance the utilities need to develop and implement effective programs.

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