Tinkering with Program Design: Using Data to Create the Next Generation of Programs

Nate Bellino and Oksana Harris, Ecova

ABSTRACT

Do ever-increasing goals, added EM&V scrutiny or disappearing low hanging fruit have you longing back to the good-old-days of energy efficiency? Unfortunately these issues are all too common for current utility programs, and some good-old-fashioned tinkering is needed to develop sound solutions.

Right now, cost effectiveness modeling often happens after products and a program design are selected. Incorporating best planning practices from top utilities and borrowing market frameworks from the high-tech industry, we attempt to redefine the current program development methodology by quantitatively assessing different products, program designs, and markets by modeling different scenarios continuously throughout the process.

Over a three month period, we investigated over 33 retail products, 10 Technical Reference Manuals, and 15 program designs to come up with 2 sound program designs for 6 retail products. Using the methodology we developed through this process, we will walk through the cost effectiveness, savings, and market analysis we conducted to base our conclusions off of. Using data to tell the story we go step by step in determining which products provide fertile ground for programs, which qualified product lists are the best option, and which program design cost effectively addresses the key market barrier for the particular product.

Introduction

Utility Energy Efficiency (EE) programs have come under increasing pressure from market and regulatory forces in recent years. With programs operating for decades in many regions, savings from low hanging fruit are drying up. Those programs that are starting out are also finding how quickly the low hanging fruit gets captured. Meanwhile, a multitude of new codes and standards continue to lower the per-unit savings attributable to voluntary programs, and we are seeing increased Evaluation, Measurement, and Verification (EM&V) scrutiny across the country. Taken together, these factors indicate that attributable savings for EE programs are becoming increasingly hard to come by.

At the same time, the value of these savings is increasing. Savings goals are rising; many states now have Energy Efficiency Resource Standards, and meeting the stated goal impacts regulatory goodwill now more than ever. Meanwhile, electric rates continue to go up and customers look to their utility for solutions, not just higher bills. 21 utilities also now have an incentive to pursue energy efficiency, tying shareholder value directly to EE programs and making these savings even more valuable.

The current situation – dwindling tried-and-true savings opportunities with a higher value placed on them – calls for a methodical approach to new product selection and program design. Incorporating best practices found in product development across industries, we have created a robust, data-based methodology that can be used to develop new ideas or test hypotheses. Rather than waiting until the end to analyze cost effectiveness, we start modeling at the beginning and continue throughout the development process. We also leverage a consistent framework across programs to assess market barriers; this allows portfolio managers to leverage similar program designs for different products and make the case for changing program focus. Since pilots and in-market testing are costly, these idea-vetting analyses and consistent modeling allow utilities to purge poor ideas early and focus on ones that show market, technical, and regulatory promise. These analyses are ideally done prior to filing an EE portfolio, yet are effective at any point in the program cycle and provide regulators ample rationale for a utility's portfolio mix and program design. This methodology can be summed up in three steps, and can be applied across portfolio segments.

Step 1: Assess Products Independent of Program Design

The process begins with setting the overall portfolio strategy. Once this is set, the next activity begins filtering product ideas within the residential and commercial and industrial segments. Starting with the products found in each area, the first step is to develop what we call a "Product TRC" or "Product UCT" for each measure.

By holding non-product-specific variables constant, utilities can determine which products provide a solid foundation to build a program around. Since much of a program's TRC is determined by factors independent of program design, this is a crucial first step. At the same time, analyzing potential studies and market information on product volume develops a high-level understanding of the savings potential in a product area. The result is a list of top products for the residential in-home, residential retail, and commercial and industrial portfolios that have a bias toward being cost effective and carry strong savings potential.

Step 2: Assess the Market and Key Barriers

The next step is to determine which product list to use for eligibility and where the core market barriers are. There are now many options to consider when choosing a Qualified Product List (QPL) that will be eligible for rebates. Some of them already have Incremental Measure Costs (IMC) and savings associated with them, however some do not.

Being able to compare all available third-party product list options and choose an appropriate one is essential to program success, particularly since the IMC and savings per unit consistently exhibit a high impact on TRC and UCT ratios. Once this is done, a value chain analysis of each product helps identify the primary distribution channels (how a product gets in the customer's hand via retail, contractor, etc.), and the primary market actors (manufacturers, retailers, etc.) in each. This allows utilities to focus efforts on the channels and actors that will result in the most impact when designing and implementing a program. This analysis also leads to assessing each of the three key market barrier areas for a product: 1) Product Preference; 2) Awareness; and 3) Availability.

Using research and data to understand what market barriers are most present can help utilities determine which area to focus on in order to develop a robust program design hypothesis.

Step 3: Model Program Designs and Test

Vetting cost assumptions for different activities within a program design provides the inputs to developing a program TRC and UCT. It is also helpful to validate the unit assumptions with market actors to solidify savings projections.

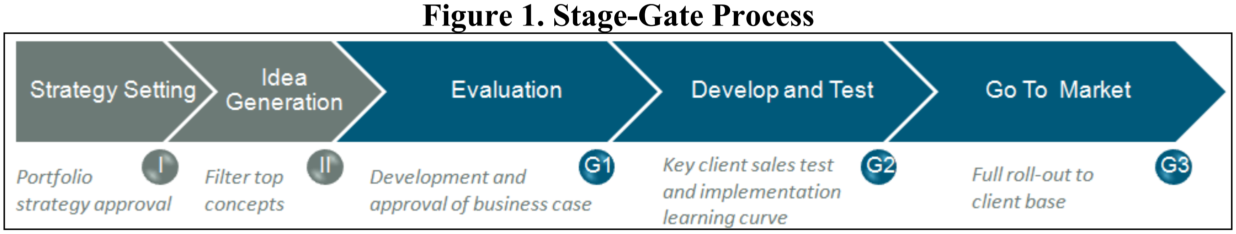
Understanding the opportunity and costs associated lead to the development of a business case to justify testing a program in market. Once approved, a market test is created, where data collection protocols and key performance metrics are established to determine if the hypotheses and assumptions made during the product development process are correct or need modification.

The Stage-Gate Development Process

This paper describes the details behind different phases in what is commonly referred to as a stage-gate product development process described below (see Figure 1). While there are many variations of the stage-gate method, this one is adapted to the utility industry and removes other phases that may be more suited for a high-tech or bio-tech firm.

While some of the leading utilities in Energy Efficiency use a stage-gate process for their product development, we have applied it so others in the industry may take advantage of this tried-and-true process. It is also important to note that throughout the process, a cross-functional team representing the core roles within a DSM organization meets regularly to discuss the analyses and potential impact on program design. This allows the organization as a whole to base decisions on similar information and analysis.

Figure 1. Stage-Gate Process



This paper details the activities involved in the Idea Generation and Evaluation stages of the product development process, two of the most important yet often overlooked phases of utility program design.

Step 1: Assess Products Independent of Program Design

Prior to assessing new product ideas, it is important to understand the strategic direction of a portfolio. While EE goals provide some guidance, a utility must determine where the immediate and long-term opportunities are. Without an understanding of where long term savings potential exists and only optimizing around the immediate year, the pipeline of EE and DR savings can dry up quickly. This paper does not detail the strategy setting efforts for portfolio planning, yet details how to deliver programs that are consistent with whatever strategy is present.

1.1 Building a measure list. All utilities review their version of a Technical Reference Manual (TRM) within their territory; however, reviewing other TRMs in the surrounding area can provide guidance on where numbers may be biased or where EM&V risk could exist. Also, TRMs often do not provide information on all the variables needed to calculate a TRC or UCT for a product. Consequently, we first developed a measure database incorporating all publicly available TRMs in the country. This allowed us to capture more complete information and calculate product-based TRCs and UCTs, as well as assess regional differences and identify trends within certain product categories. Products not found in TRMs require engineering and market analysis to determine the savings per unit, incremental measure cost, estimated useful life and other product specific variables.

1.2 Developing the product TRC and UCT. TRMs allow a utility to collect the basic information needed to develop measure-specific TRC and UCT calculations such as savings/unit, IMC, and useful life. Holding other variables constant across different products, the next step is to determine the Product TRC (P-TRC) and Product UCT (P-UCT). Modeling the P-TRC and P-UCT of all available products within a product category or segment (i.e., Residential Retail Products or C&I) allows the utility to see which products are naturally cost effective prior to committing resources to developing a program around them. While simple in concept, some of the results can provide key insights for portfolio managers. For example, in our meta-analysis of products found in TRMs across the country, we found that on average, even if a clothes washer program had $0 in Administration, Implementation, Marketing, and Incentive costs, and a 1.00 Net-to-Gross, it would still not be cost effective.

Table 1 is a list of variables for the Product TRC and UCT. While there are other cost effectiveness tests for utility programs, we have focused on TRC and UCT as these are most often the key tests for a portfolio. Other product-specific cost effectiveness tests would follow a similar logic regarding which variables to hold constant as found below.

Table 1. Product TRC and UCT Variables

TRC/UCT Variable	Constant or Product Specific
kWh savings / unit	Product Specific (TRM)
kW savings / unit	Product Specific (TRM)
Therm savings / unit	Product Specific (TRM)
Estimated Useful Life	Product Specific (TRM)
Incremental Measure Cost (IMC)	Product Specific (TRM)
Incentive / unit	Constant (% of IMC, or absolute value)
Administrative, Implementation, & Marketing / unit	Constant (average among programs)
Discount Rate	Constant (Utility)
Avoided Cost	Constant or Product Specific (depending on state)
Net-to-Gross	Constant or Product Specific (depending on TRM)

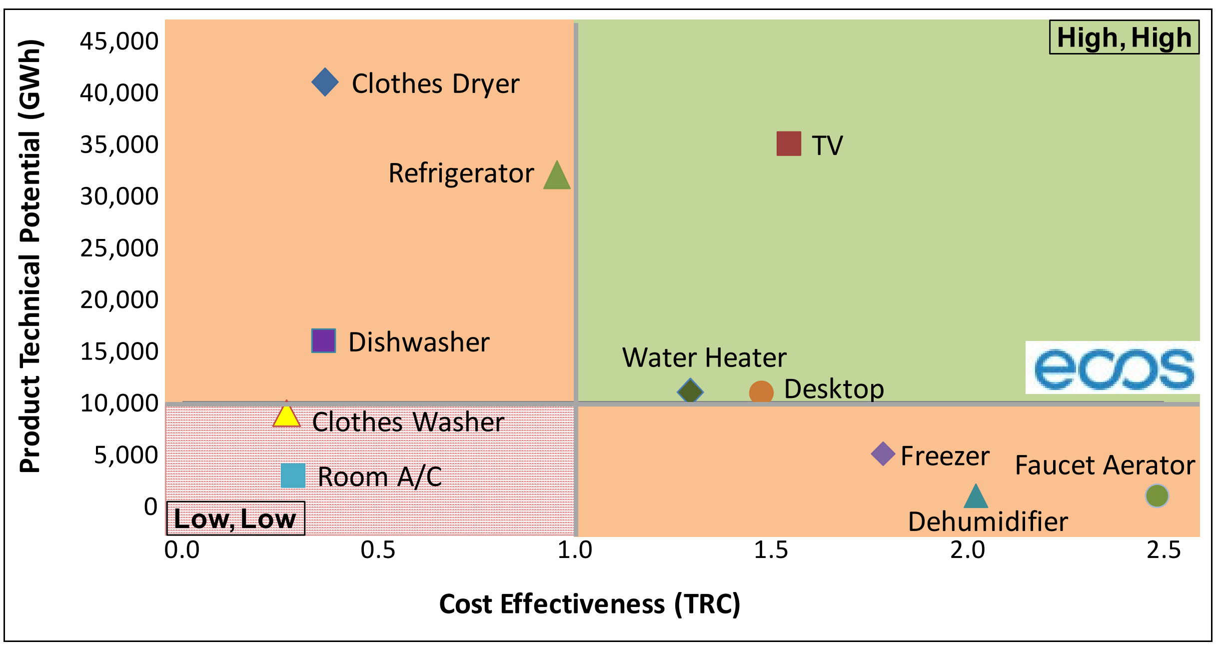
For those products that are considered yet not included in any TRM in the country, this step would include assessing the savings, IMC, and useful life from other sources. Manufacturer claims and third party lab or field test results can provide the foundation of savings estimates and some assessment of useful life. However, the IMC must be determined through primary market research. Details on developing an IMC can be found in Section 1.6.

The result of this exercise is a rank order list of measures within a product category or segment according to their P-TRC and P-UCTs. While it is helpful to understand which products are naturally cost effective, utilities and regulators do not want to spend resources developing programs around products with little savings potential.

1.3 Capturing the savings and volume potential. While some utilities have specific market potential studies for their state or territory, others must rely on those done in other states or regions for guidance. These studies most often provide a solid understanding of the technical potential of a particular product, and these technical potential numbers are a key data point in determining which products to pursue. However, estimating market potential always becomes more complex. As a way to vet market potential numbers from different studies, it is helpful to understand the sales volume of different products. There are a number of sales estimate methods that could work, depending on the type of product and distribution channel. More information on the different methodologies associated with sales volume estimates is available upon request.

Understanding the savings and volume potential and the P-TRC and P-UCTs of different products allows utilities to view which products carry strong savings potential and cost effectiveness and forms the basis of product selection. Figure 2 illustrates a product assessment chart developed when combining P-TRCs and P-UCTs with savings potential:

Figure 2. Product Cost-effectiveness and Savings Potential



1.4 EM&V risk, scalability, and other assessment criteria. In addition, criteria that affect EM&V risk and scalability of a program should be considered. For example, product performance or installation may differ depending on consumer behavior, contractor know-how, regional weather differences, etc. Through a collaborative stakeholder engagement, utilities can establish which criteria to focus on and determine which products become top options for program development. Figure 3 is an example of product ranking combining the P-TRC/UCT, savings, and additional EM&V risk and scalability criteria.

Figure 3. Product Assessment Criteria

Group 1 - "straight-forward" products with TRC close to or above 1.0

Product	Total Resource Cost Test	EPRI Electric Tech Potential (GWh)	Itron Gas Tech Potential (MM Therms)	Sold at Retail Locations?	Commercially Viable?	Climate Dependent Savings	Fuel Type Dependent Savings?	Behavior Dependent Savings? (have to continuously opt in)
Dehumidifier	2.02	1,000		Yes	Yes	No	No	No
Freezer	1.78	5,000		Yes	Yes	No	No	No
TV	1.54	35,000		Yes	Yes	No	No	No
Desktop	1.48	11,000		Yes	Yes	No	No	No
Refrigerator	0.95	32,000		Yes	Yes	No	No	No
Water Heater	1.29	11,000	785	Yes	Yes	No	Yes	No

Group 2 - products with good TRC and potentially tricky scalabilit/program design

Product	Total Resource Cost Test	EPRI Electric Tech Potential (GWh)	Itron Gas Tech Potential (MM Therms)	Sold at Retail Locations?	Commercially Viable?	Climate Dependent Savings	Fuel Type Dependent Savings?	Behavior Dependent Savings? (have to continuously opt in)
Thermostat	9.42	25,000		Yes	Yes	Yes	Yes	Yes
Pipe Insulation	4.60	4,000	110	Yes	Yes	Yes	Yes	No
Showerhead	4.20	8,000	206	Yes	Yes	No	Yes	No
Ceiling Fans w/ CFLs	2.99	2,000		Yes	Yes	Yes	No	No
Air Sealing	2.89			Yes	Yes	Yes	Yes	No
Faucet Aerator	2.48	1,000	168	Yes	Yes	No	Yes	No
Insulation	1.88	2,597	3,908	Yes	Yes	Yes	Yes	No
Pool Pump	1.39			Yes	Yes	Yes	No	No
Windows	1.16	2,414		Yes	Yes	Yes	Yes	No
Smart Strip	0.91			Yes	Yes	No	No	No

This rank order list filters for the top products associated with a segment or category and is the final step in the Idea Generation phase. After ensuring these products are strategically aligned, and gaining approval, the next step is to begin the Evaluation phase and conduct further due diligence on the market of a product.

Step 2: Assess Market and Key Barriers

2.1 Market value chain. Every energy efficient product has a path it takes to the end-customer. Depending on the product category, different market actors have greater influence on what gets presented and sold to customers. For a program to be effective, it must understand the different paths (distribution channels) a product takes and who the primary manufacturers, retailers, and contractors are. Figure 4 is an example of the value chain for Televisions.

Figure 4. Television Value Chain

This analysis provides some key insights regarding program design, and also offers data points useful in forecasting potential unit volume. For example, through our Water Heater value chain assessment, we learned that 50% of customers purchase through retailers and 50% through contractors. Because of this, a water heater program that only covers one of these channels would be limited in its effectiveness.

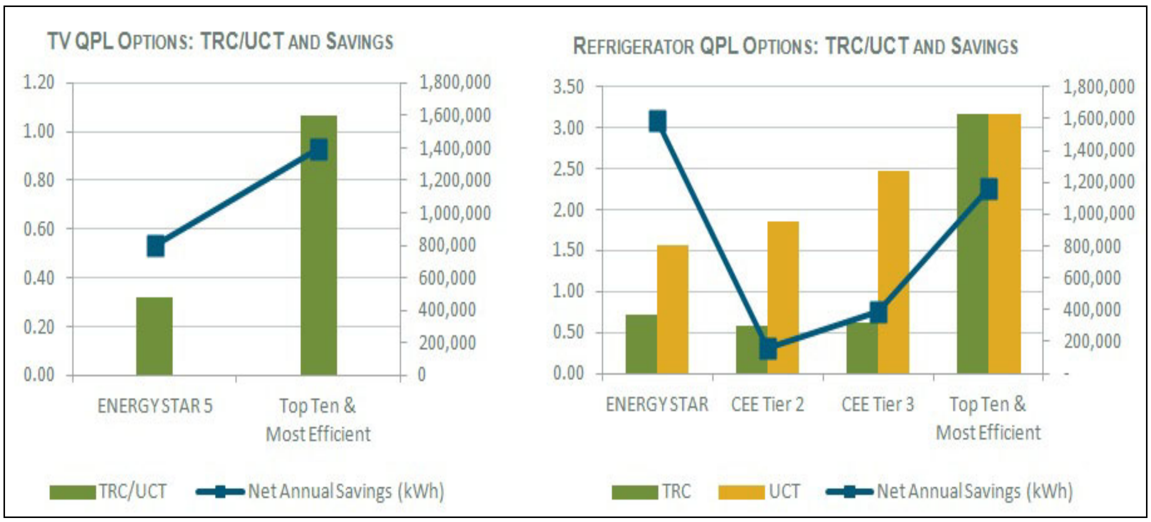
2.2 Assess third-party qualified product lists. Utility programs are highly dependent on the Qualified Product List (QPL) used. The QPL determines the unit savings value and incremental measure costs—two variables that have significant impact on TRC and program savings results. The next step is to delve deeper into the savings and IMC options that each QPL provides. Beyond savings and IMC, each QPL has specific availability and corresponding market share associated with it. For example, ENERGY STAR® refrigerators have a 30% market share, yet Consortium for Energy Efficiency Tier 2 and Tier 3 refrigerators have 1% and 3% market shares respectively. While too much availability or too high a market share poses free-ridership risk, too little availability unnecessarily constrains a program. The challenge is to find the right balance and monitor over time.

While ENERGY STAR and CEE tiers have been the QPL of choice for programs, there are now different options to consider. ENERGY STAR's Most Efficient and TopTen USA, for example, provide a high average savings value and have market shares of 11% and 5% respectively in TVs. We have also uncovered interesting findings regarding their IMC.

There are two primary methodologies to establish an Incremental Measure Cost: 1) Determine the added cost in making the product energy efficient, then assume manufacturer and distributor mark-ups according to standard industry practice to arrive at the theoretical IMC, or 2) Collect all available pricing data on the efficient product and statistically determine the true IMC to a consumer. While the cost-based method seems reasonable, we have found that the assumption that production costs automatically result in a higher retail price does not hold with at least two product categories: TVs and Refrigerators. Our research shows that the most efficient products in these categories – those eligible for ENERGY STAR's Most Efficient and TopTen USA's lists – cost no more than the non-efficient option. This is an important finding, as it means that not only do these products save more than normal, but they also are ripe for a robust program design due to a zero or near zero IMC.

After determining the savings and IMC data for each QPL within a product category, the next step is to model each QPL's TRC, UCT and savings opportunity. This exercise clearly shows which QPL will result in the most cost effective program with optimal savings. An example of this analysis is shown in Figure 5.

Figure 5. TV and Refrigerator QPL Modeling



2.3 Assess the three primary barriers. Before new products are introduced into a market, Consumer Packaged Goods and High Technology firms often use two similar models to forecast sales. One of these models is BASES, which is proprietary to AC Nielsen, and has been used by CPG firms for decades. The other method is offered by Robert Thomas in his book *New Product Development: Managing and Forecasting for Strategic Success*. Both methods base their sales forecasts on three primary variables: Product Preference, Awareness, and Availability. We have found that these three variables provide an excellent framework for assessing where the key market weakness is for a product and are instrumental in program design. Essentially, the program designer uses secondary research (primary if no secondary research exists) to gauge 1) the key features consumers prefer in a product category, incremental price and overall quality of the energy efficient product; 2) the level of awareness and complexity; and 3) the percentage of availability in the market. By determining in which of these three factors a product is weakest, we are able to focus the program design on the primary market barrier it faces. Conversely, if a product is weak in all three areas, we now understand that a program that does not impact all three will not be as effective.

For example, when assessing Refrigerators, we found that there was no incremental cost and manufacturers were somewhat limited in their ability to produce ever more efficient models. However, the availability of the most efficient options was a significant constraint, and consumers were unaware of which options were most efficient. As a result, we designed a mid-stream program to affect availability on retailer shelves and improve in-store communication regarding the most efficient Refrigerators.

Step 3: Model Designs and Test

3.1 Program design TRC, UCT and savings modeling. At key points along the program development process, we have modeled TRC, UCT and savings while holding key variables associated with program design constant in order to make decisions about different aspects of the program (product focus, QPL, etc). After gaining an understanding of the market, the next step is to return to these inputs and test the impact of different program designs on TRC, UCT and savings. With savings per unit and incremental cost now held constant, we begin to develop hypotheses and assess the implementation, marketing, admin and incentive costs associated with different program delivery methods, along with unit volume impact. Many new program ideas leverage activities of current or historical programs. Understanding the costs associated with these different activities is critical in developing accurate, valid modeling assumptions for new program design. Activity-based costing is a sound method for developing these estimates, yet this level of understanding is often unavailable. Ideally, when beginning the program development process, an activity-based costing effort would begin to yield results when entering Step 3.

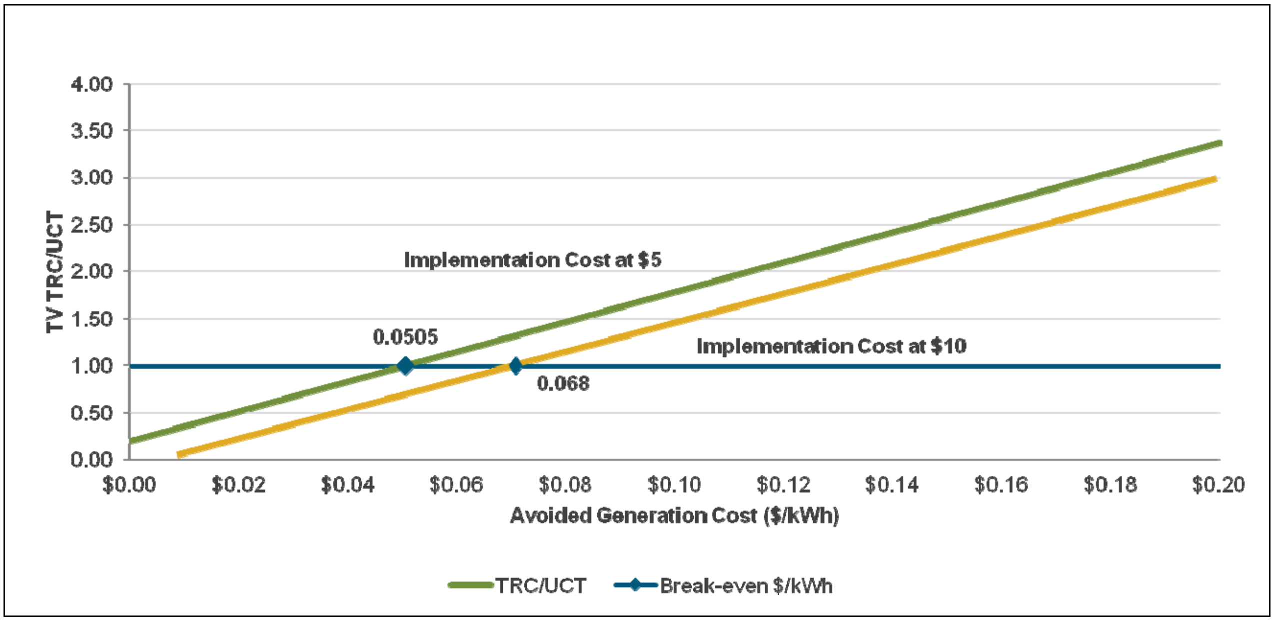
For those activities that have not been tried before, cost estimation involves partnering with the Implementation team to conduct due diligence regarding the direct costs and/or labor needed to perform the work. As an example, we assessed the viability and costs associated with in-store education centers for all of our retail products. We worked with our Implementation team to establish labor hours associated with manning the booth, and contacted our retail partners for additional feasibility and cost feedback.

Beyond incentive processing and administration, understanding the Customer Engagement and EM&V activities associated with a program design is crucial in developing a sound program. New forms of Customer Engagement can bring higher attribution and customer satisfaction, yet planning typically occurs after a program is filed. It is also vital that the program include activities that capture data that can monitor its effectiveness and help EM&V efforts.

As the overall Administration costs are developed, Incentive level ranges are also determined depending on the incremental cost and who receives the incentive. With Refrigerators, we saw no incremental cost to the customer, so a customer incentive was seen as a secondary option. As a primary tactic to impact the availability and in-store awareness, we looked at an incentive to retailers at a range of \$5-\$15. We also modeled a customer incentive; however this resulted in a TRC well below 1, and would have been a better choice if price premium were the main market barrier. While a manufacturer incentive would have also worked to increase availability, it would not have helped as much with in-store education as incenting the retailers to provide in-store promotional activities themselves, which would impact unit volume attributable to the program.

We have been assuming that the avoided cost remains constant throughout our modeling efforts. Yet there is some regulatory risk associated with these values across program planning periods, and for those utilities operating in different states it is helpful to determine the sensitivity of the TRC and UCT to different avoided cost values. Once activity-based costs and incentives are established, the next step is to perform sensitivity analysis of TRC and UCT to possible changes in avoided costs over the planning period or by location. In Figure 6, we show how an increase in the avoided cost to $.068 allows a program to perform additional activities ($10/unit vs. $5/unit) and still remain cost effective.

Figure 6. Avoided Generation Cost Analysis



This analysis would help a utility assess the robustness of the program design's TRC and UCT and tweak program design or develop risk mitigation strategies, if needed.

3.2 Unit volume and savings modeling. Beyond TRC and UCT modeling, different program design features impact unit volume as well. For example, programs that require customers to fill out rebate forms suffer from breakage (customers who purchased an energy efficient product but did not submit a rebate application). A POS rebate, however, does not suffer from breakage, and therefore, results in a higher overall unit volume, in addition to reducing processing costs. While the net-to-gross may be lower for a POS rebate, the net result is still higher savings.

Incentive levels may also drive unit volume. Understanding the price elasticity of a product is essential in forecasting the impact of setting different incentive levels. Unfortunately, this information is not common and often requires in-market testing to develop. Essentially, this step involves developing assumptions on the price elasticity by comparing a product to an analogous offering and performing sensitivity analysis. By modeling different program design options, a utility develops a solid understanding of the savings and cost effectiveness impacts inherent in a program prior to bringing it to market. It allows for multiple design ideas to be tested in a lab-like setting so utilities can quickly shed poor ideas and focus on ones that are most likely to produce strong results.

The end result is a TRC, UCT and savings analysis of the top program designs that form the opportunity basis for a business case. This, coupled with an understanding of costs, provide the information necessary for utilities to decide whether to bring a program to market.

The results of a more data-driven approach to program design are encouraging. One of the programs developed in the above exercise is currently being implemented, having passed initial EM&V and regulatory scrutiny. Other designs are currently going through the regulatory process, which has been made easier as a result of having an established methodology and upfront data analysis on multiple scenarios prior to preparing for a filing. What's most encouraging, however, is that because of the constant interaction and analysis inherent in this process, program managers are now prioritizing delta watts, incremental measure cost, and cost effectiveness earlier in program design, resulting in a higher probability of future success. As we gain historical data and compare projections to performance we will continue to optimize program savings and collect the data needed to mitigate EM&V risk, attempting to further enhance our ability to develop the best program designs possible that lead to the most savings for utilities and their customers.

Conclusion

A rigorous method for developing DSM programs is needed now more than ever. Through a comprehensive market assessment and modeling cost effectiveness and savings impacts, utilities can focus their efforts on programs that are most likely to succeed and produce strong results. It also provides solid rationale for a program to regulators and stakeholders that limits EM&V risk. In the end, utility customers are more likely to be served better when upfront analysis takes place, which is the goal of utilities, regulators, stakeholders and implementers alike.

References

Efficiency Vermont. 2010. *Technical Reference User Manual: Measure Savings Algorithms and Cost Assumptions*. http://www.veic.org/Libraries/Resumes/TechManualEVT.sflb.ashx. Burlington, Vt.: Efficiency Vermont.

Energy and Environmental Economics, Inc., Rocky Mountain Institute. 2004. *Methodology and Forecast of Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs.* San Francisco, Calif.: California Public Utilities Commission.

KEMA. 2006. Energy Efficiency Program Best Practices. In National Action Plan for Energy Efficiency. *National Action Plan for Energy Efficiency Report.* http://www.epa.gov/cleanenergy/documents/suca/napee_report.pdf. Washington, D.C.: U.S. Environmental Protection Agency Office of Air and Radiation.

Maine Public Utilities Commission. 2006. *Technical Reference User Manual: Measure Savings Algorithms and Cost Assumptions*. No. 2006-1. Augusta, Me.: Maine Public Utilities Commission.

Maine Public Utilities Commission. 2009. *Efficiency Maine 2009 Annual Report.* http://www.maine.gov/tools/whatsnew/attach.php?id=87344&an=1. Augusta, Me.: Maine Public Utilities Commission.

Massachusetts Energy Efficiency Advisory Council. 2011. *Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Plan Version.* http://www.ma-eeac.org/docs/MA%20TRM_2011%20PLAN%20VERSION.PDF. Boston, Mass.: Massachusetts Energy Efficiency Advisory Council.

Michigan Public Service Commission. 2011. *Michigan Energy Measures Database.* http://www.michigan.gov/mpsc/0,4639,7-159-52495_55129---,00.html. Lansing, Mich.: Michigan Public Service Commission.

National Action Plan for Energy Efficiency. 2008. *Model Energy Efficiency Program Impact Evaluation Guide. http://www.epa.gov/cleanenergy/documents/suca/evaluation_guide.pdf.* Washington, D.C.: U.S. Environmental Protection Agency Office of Air and Radiation.

National Action Plan for Energy Efficiency. 2008. *Model Energy Efficiency Program Impact Evaluation Guide. http://www.epa.gov/cleanenergy/documents/suca/evaluation_guide.pdf.* Washington, D.C.: U.S. Environmental Protection Agency Office of Air and Radiation.

National Action Plan for Energy Efficiency. 2008. *Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers.* http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf. Washington, D.C.: U.S. Environmental Protection Agency Office of Air and Radiation.

National Action Plan for Energy Efficiency. 2008. *Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers.* http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf. Washington, D.C.: U.S. Environmental Protection Agency Office of Air and Radiation.

New York Evaluation Advisory Contractor Team. 2010. *New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs: Residential, Multi-Family, and Commercial/Industrial Measures.* http://www.dps.ny.gov/TechManualNYRevised10-15-10.pdf. Albany, N.Y.: New York Department of Public Service.

Nexus Market Research, Inc., RLW Analytics, Inc. 2007. *Process and Impact Evaluation of the Efficiency Maine Lighting Program.* http://www.efficiencymaine.com/docs/emresidentiallightingevaluation.pdf. Augusta, Me.: Maine Public Utilities Commission.

Northeast Energy Efficiency Partnerships. 2010. *Mid-Atlantic Technical Reference Manual: A Project of the Regional Evaluation, Measurement and Verification Forum.* Version 1.0. http://neep.org/uploads/EMV%20Forum/EMV%20Products/Mid%20Atlantic%20TRM_V1d_FINAL.pdf. Lexington, Mass. Northeast Energy Efficiency Partnerships.

Pennsylvania Public Utilities Commission. 2011. *State of Pennsylvania Technical Reference Manual: Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards.* http://www.puc.state.pa.us/electric/Act129/TRM.aspx. Harrisburg, Pa.: Pennsylvania Public Utilities Commission.

Regional Technical Forum. 2011. "RTF Unit Energy Savings (UES) Measures and Supporting Documentation." http://www.nwcouncil.org/energy/rtf/measures/Default.asp. Portland, Ore.: Regional Technical Forum.

State of Vermont Public Service Board. 2009. "Workshop Process on Cost-Effectiveness Screening of Heating and Process-Fuel Efficiency Measures." http://psb.vermont.gov/docketsandprojects/eeu/screening. Montpelier, Vt.: State of Vermont Public Service Board.

Thomas, Robert J. 1993. *New Product Development: Managing and Forecasting for Strategic Success*; New York, N.Y.: John Wiley & Sons.

Vermont Energy Investment Corporation. 2010. *State of Ohio Energy Efficiency Technical Reference Manual: Including Predetermined Savings Values and Protocols for Determining Energy and Demand Savings*. http://amppartners.org/pdf/TRM_Appendix_E_2011.pdf. Burlington, Vt.: Vermont Energy Investment Corporation.