Home Appliance Programs Hit the Wall

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ABSTRACT

For nearly 30 years, efficiency program administrators in the United States have operated programs to encourage customers to select and purchase efficient appliances. This voluntary approach to appliance product efficiency has contributed to the increase in efficiency for refrigerators, dishwashers, and clothes washers. However, the efficiency gains get smaller each year, and the number of consumers who indicate they would have bought the efficient appliances anyway increases, causing reduced net savings for the programs and, thus, reduced program cost effectiveness. Program administrators need to either increase the number of participants beyond those who would buy efficient products anyway, find lower cost ways to stimulate the sale of energy efficient appliances, or find new products that will provide efficiency gains in a similar manner to the tried and true.

This paper reports findings from a market characterization of end-use specific plug-load products (appliances), a review of program design options for all plug-load products (electronics and appliances), an assessment of the evaluability of the different program designs, and a process evaluation of an existing statewide appliance program using different incentive strategies (on-line, in-store and mail-in). The results of the study point to opportunities to address the concerns, while necessitating adjustments to the evaluation approach and possibly the way cost effectiveness is calculated.

Why This Study? Why Now?

California utilities have offered energy efficiency programs to their customers for more than 30 years. In delivering these programs, they have always sought to work with market actors, for example, by bringing energy efficiency into a retailer's standard sales process. The two largest California utilities, Pacific Gas & Electric (PG&E) and Southern California Edison (SCE), commissioned this study to find new ways to implement appliance programs. They wanted to build on previous successes to evolve the design of their programs such that they would be simple yet comprehensive, and make energy efficiency accessible to their customers while working within the existing supply chain infrastructure.

Evidence-Based Program Design: Putting Process Evaluation and Market Characterization to Use in New Ways

This study was one of three separate but concurrent lines of inquiry, which also included a process evaluation of the Home Energy Efficiency Rebate (HEER) program and a general population survey that asked Californians about a variety of energy-related issues. The scope of work for the program design study specified a market characterization, but little else. Therefore, the team put aside the question of coming up with new program design ideas to apply itself to the typical tasks of market research.

For three months, the evaluation team conducted in-depth interviews with a variety of market players, tracked down and plotted trends in product sales and market share, and learned the pros and cons of efficient technologies. The project team also thought it was important that the desire for innovation and creativity be balanced with the need for proven success. Therefore, as part of the initial research the team conducted a program strategy review, seeking examples from appliance programs outside California and the

U.S., and other efficiency programs in general, that might yield new ideas for the HEER program. Refrigerators, proved to be among the most illustrative of the challenges and the opportunities for appliance programs in at the start of this decade.

Case Study: Refrigerators

Refrigerators have been the backbone of the SCE HEER program, comprising about 90% of all incented measures in 2010 and accounting for 85% of program savings. The refrigerator rebate ($50 for ENERGY STAR®-qualified products) also suffered from high freeridership estimates; 66% percent of refrigerator purchasers surveyed (program participants in 2006-2008) said they would have been "very likely" to make the purchase even if the HEER incentive would not have been available and 22% would have been "somewhat likely."[1] The utility's key research question was, "What can we do to lower freeridership?"

Both the previous and current program evaluations demonstrated that customers placed low priority on efficiency, and rebates, when selecting a refrigerator. Awareness of the refrigerator rebates among SCE customers was higher than any other product: 78% among the general population and 98% among program participants. Yet only 2% of buyers surveyed in 2011/2012 chose their model because of its efficiency. Although 12% of buyers said they discussed ENERGY STAR with the retail sales staff, only 2% discussed the SCE HEER program rebate (Peters et al. 2012). Clearly, the program rebate was not proving to be a "necessary" factor in ENERGY STAR-buyers' decision-making process. Why not?

The market characterization provided one possible answer, although it too started with a question. Why is the penetration of ENERGY STAR refrigerators lower than for other major appliances, when many of the barriers present for other products are not apparent in the refrigerator market? Penetration of ENERGY STAR refrigerators was around 30% from 2007 to 2009, rising to 50% in 2010, a lower penetration rate than clothes washers and dishwashers (EPA 2010). Yet ENERGY STAR refrigerators were widely available at major retailers (Peters et al. 2012).Three-quarters of buyers replace refrigerators while they are still working, so there is no aversion to early replacement (US Dept. of Energy 2009).Efficient refrigerators look and work just like baseline units.

The market research conducted for this study showed that 70%-90% of all refrigerator models at leading U.S. retailers such as Best Buy, Sears, and Lowe's were ENERGY STAR qualified (Figure 1). Since a majority of models were qualified, but ENERGY STAR penetration was at 50%, it seemed that a small fraction of models were responsible for a disproportionate percentage of total sales.

An analysis of ENERGY STAR models by price point provided a likely explanation. Although ENERGY STAR-qualified refrigerators were a majority of models at most price points, there was a much more limited selection at the lowest two price points (refrigerators priced under $750). The researchers were unable to obtain unit sales data by price point, but interviews with manufacturers confirmed that a high proportion of sales occur at these low or "entry level" price points, also referred to as "volume" price points.

[1] Refrigerator share of total SCE HEER program measures calculated from HEER program documents provided by SCE. Previous refrigerator measure freeridership rate reported in KEMA (2009) *Process Evaluation of Southern California Edison's 2006-2008 Home Energy Efficiency Rebate (HEER) Program: Final Report.* Report ID: SCE0278. Freeridership is the primary means used to adjust gross savings and account for the savings that was actually influenced by the program, thus the net savings. While participant spillover can be included in net adjustments for California programs, the difficulty of measuring spillover is great. Nonparticipant spillover is only included in estimates of net market effects and such efforts have not been attempted for plug-load products. The use of self-reports is the primary approach used for net savings adjustments for these plug-load programs.

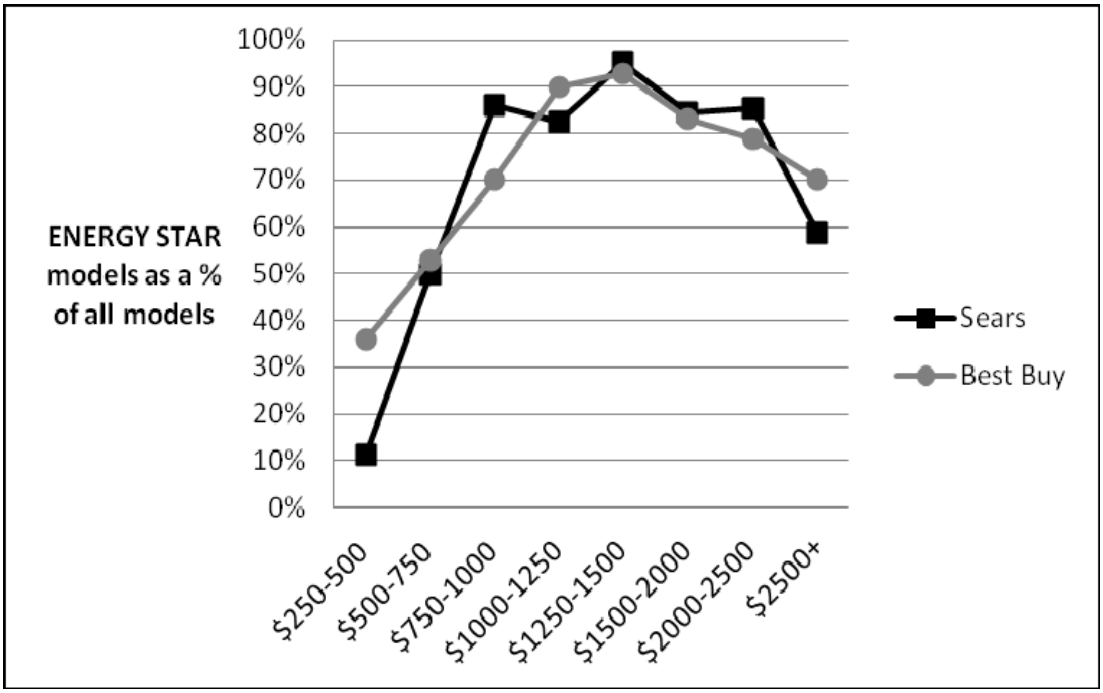

Figure 1. Percent of ENERGY STAR-Qualified Refrigerator Models at Various Price Points, Best Buy (October 2011) and Sears (December 2011)

Sources: www.bestbuy.com (accessed October 27, 2011); www.sears.com (accessed December 14, 2011)

Further, we conducted a semi-systematic review of products for sale on leading retailers' websites looking for the incremental cost at price points with fewer than 70% ENERGY STAR-qualified models and found an incremental cost difference between ENERGY STAR and non-ENERGY STAR products at only the lowest price point (refrigerators priced under $500). Thus, the many refrigerator buyers in the market for a low-cost product have fewer ENERGY STAR models to choose from than buyers of mid- and high-end products. These cost-sensitive buyers are also faced with a higher incremental cost, estimated at $100 or as much as 25% of the total product cost, if they chose the ENERGY STAR option.

The relatively low penetration of ENERGY STAR refrigerators, despite seemingly few barriers to adoption, seems to result from a high volume of sales of low-priced, baseline efficiency models. The reason for the low ENERGY STAR penetration may also explain high program freeridership. When refrigerator buyers were asked why they did not purchase an ENERGY STAR model, more than half said that product cost was the main reason (Peters et al. 2012). Because the market research showed, anecdotally, no difference in incremental cost of ENERGY STAR products at all but the lowest two price points (under $750), it suggests that these buyers were indeed choosing from among the lowest-priced products.

An analysis of a portion of SCE HEER program incentive data from 2008-2010 confirmed this hypothesis. Data collected by the SCE HEER program included the brand and model number for each incented unit, but not the manufacturer's suggested retail price (MSRP). One of the leading worldwide refrigerator manufacturers (referred to here as "Brand X") provided the MSRP for all of its active model numbers, or between 46% and 98% of all incented Brand X refrigerators per program year (Table 1).

Table 1. Refrigerator MSRP Availability by Year, Brand X

Year	Units Incented	MSRP Available	Percent Available
2008	3,775	1,727	**46%**
2009	4,669	3,916	**84%**
2010	927	912	**98%**
Totals	9,371	6,555	**70%**

Using the program incentive data and the Brand X-supplied MSRP confirmed that in each of the three program years (2008-2010), more than 97% of Brand X refrigerators incented by the SCE HEER program (and for which MSRP was available) had an MSRP greater than $1,000. (See Figure 2.)

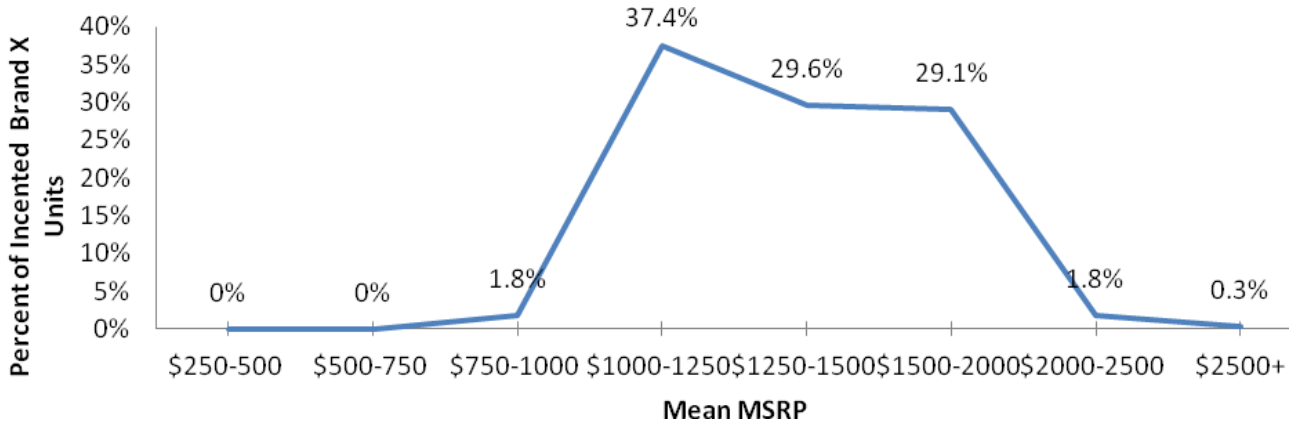

Figure 2. Price Point of Incented Brand X Refrigerators (2008-2010)

Generating Program Design Ideas

Once the market research and process evaluation were complete, the project team turned to generating program design ideas. The utilities wanted program designs that were new and creative but also met a set of clearly defined criteria. The programs should be:

- As simple and easy to administer as possible
- Easy for end users and supply chain partners to understand and participate in
- Likely to generate savings that will be attributed to program activities
- Evaluable, meaning that evaluators will be able to identify and quantify the savings

To these the project team added a few more, wanting the new program design ideas to be:

- Evidence-based, i.e. indicated by the HEER process evaluation research and the product market research
- Suitable for collaboration with other utilities and/or ENERGY STAR

A Systematic Approach to Program Design

The researchers used a systematic approach to move from market research and evaluation findings to program design recommendations in order to ensure the results were both comprehensive and equitable, in other words, that all program design possibilities had been considered equally. The process included four

steps and is an approach to program design that is content-neutral – it can be applied to energy efficiency programs of any type, in any market. The approach is primarily qualitative, but with quantitative elements, using a Microsoft Excel workbook-based tracking and organizational tool.

Step #1: Assess and Prioritize the Barriers to Energy Efficiency. The first task in this approach to designing a program that is firmly rooted in market knowledge is to assess and rank the problems the program will try to solve. The team's approach to identifying barriers was both quantitative and qualitative, and specific to each product. The first task was to identify the market penetration of efficient products to gauge whether the measures were at a saturation point or still had room to improve. Table 2 lists penetration findings for the four products studied.

Table 2. Market Share of Efficient Products

Product Type	Efficient Product Qualifications	Market Share (Description)
Refrigerator	ENERGY STAR	50% new unit sales, U.S. (2010) 31% new unit sales, Calif. (2009) 28% new unit sales, Calif. (2008) 36% new unit sales, Calif. (2007)
Water Heater	ENERGY STAR storage (gas)	12% gas storage sales, U.S. (2010)
	Tankless	~10% gas water heater sales, U.S. (2010) ~5% all water heater sales, U.S. (2010)
	Heat pump (electric)	2% electric water heater sales, U.S. (2010)
Pool Pump	Variable-speed	May be up to 33% of all new unit sales, U.S. (2011) Contractors and manufacturers report variable speed pumps outselling two-speed pumps in Calif. and in the U.S.
Clothes Dryer	Heat Pump (electric) clothes dryer	0% new unit sales, U.S. (to date)

Sources: ENERGY STAR 2007, 2008, 2009; ENERGY STAR 2010a; ENERGY STAR 2010b; NEEA 2011a; ACEEE 2011b.

After the team identified the important barriers for each product, based on the market and process research, they selected the single most important barrier. Table 3 lists the key and secondary barriers identified for each product type. With one exception, the team placed no restrictions on the identification or prioritization of barriers. However, based on the seminal 1996 market transformation Scoping Study (Eto, et. al. 1996), team members did not permit "first cost" to be selected as a key barrier. The Scoping Study argued that although first cost is a common barrier to the adoption of efficient products and services, it is typically the effect of other, more fundamental barriers. For example, the high cost of a product may result from the fact that few units are produced, or the high cost of a particular component. In addition, the study noted that

programs that address only first cost run the risk that, "Discontinuation of the program would . . . result in a reversion to purchasing and operating practices that existed prior to the program."

Table 3. Barriers by Product Type

Barriers	Product Type			
	Refrigerator	**Water Heater**	**Pool Pump**	**Clothes Dryer**
End user awareness/knowledge of energy efficient products or benefits lacking	x	x	x	x
First cost high, relative to baseline product (at some price points)	x	x	x	x
Retailer or contractor awareness/knowledge of energy efficient products or benefits lacking		x	x	x
Availability low at retail or wholesale	x	**#1**		x
Energy efficiency not a key purchase criteria	**#1**	x		
Enforcement of existing codes or standards lacking			**#1**	
Voluntary label lacking				x
Codes/standards/testing procedures disadvantage energy efficient products				**#1**
Early replacement aversion		x	x	
Technology unfamiliar		x	x	
Availability low from manufacturers				x
Product performance - requires different expectations from end-users				x
Rebates not key purchase criteria	x			
Retailers do not promote energy efficient products		x		
Space or structural requirements for energy efficient products are increased or different		x		

Step #2: Identify Intervention Points in the Supply Chain to Address Each Barrier. Using the barriers as a starting point, the team drew again on their knowledge of the product markets and efficiency programs to identify, for each barrier, where in the product's supply chain an intervention might be effective. This assessment was an exercise in the hypothetical, in which the team considered each intersection between barrier and supply chain player in turn, speculating on what, if any interventions might have an impact.

Table 4 shows a sample barrier, end user awareness/knowledge, and the potential supply chain interventions for each product.

This assessment found general alignment among the products regarding intervention points. Brands, retailers, and end users are potential intervention points for many barriers and products, particularly those purchased at retail. Products that move through contractor/installer channels like water heaters and pool pumps differ accordingly.

Table 4. Leverage Points by Product, for Barrier "End user awareness/knowledge of energy efficient products or benefits lacking."

	Leverage Point							
Product Type	**Component Supplier**	**Manu-facturer/ OEM/ ODM**	**Brand**	**Whole-saler**	**Contract-or/ Installer**	**Retailer**	**End User**	**Govern-ment Agency/ Other**
Refrigerator			x			x	x	x
Water heater			x		x	x	x	x
Pool pump			x		x	x	x	x
Clothes dryer			x			x	x	x

Step #3: Match Strategies to Barriers to Products. Now that the team had determined which barriers the program would need to target and at which points in the supply chain, we needed a systematic way to figure out which intervention strategies might work, in preparation for evaluating them. The process, once designed, was quick to complete. The team compiled a list of more than 20 possible strategies based on the comparative strategy research tasks, although a list could be compiled in any number of ways – based on a team's own experience, a more formal best practice study, or a creative brainstorm. The team collectively evaluated each strategy on several points, using Microsoft Excel to track their conclusions: barriers addressed, applicable products, points in the supply chain it could target, and which of the ranking criteria it met. The team used the resulting strategy matrix to assign potential strategies to each barrier/supply chain intervention point. Table 5 shows the findings for the end user awareness barrier for refrigerators.

Table 5. Strategies by Leverage Point, for Barrier "End user awareness/knowledge of energy efficient products or benefits lacking."

Product	Leverage Point							
	Component Supplier	**Manu-facturer/ OEM/ ODM**	**Brand**	**Whole-saler**	**Contract-or/ Installer**	**Retailer**	**End User**	**Govern-ment Agency/ Other**
Refrigerator			1, 3, 6			1, 3, 5, 8	1, 2, 4, 7	3

Strategies:

1. Limited time incentives, varied based on incremental cost of efficient product over baseline product
2. Online marketing tactics, including retailer website marketing, social media campaigns, customer loyalty campaigns, product reviews via blogs
3. Improved POS marketing and price tag marketing (for example, simplified information, inclusive labeling, differentiation of efficient product price tags, labeling of super-efficient products)
4. Promotion of user-friendly product lists (for example, TopTenUSA, ENERGY STAR Most Efficient, utility-qualified lists)
5. Co-funded marketing with retailers
6. Co-funded marketing with brands
7. Bill inserts, other utility-sponsored direct mail
8. Retailer training

Step #4: Prioritize Strategies. The team used the strategy matrix to rank each the potential strategies for every product based on the criteria established at the outset of the project. In total, the team considered upwards of ten strategies for most of the products. They included the application of incentives at various points in the supply chain and a wide range of marketing and training activities. The prioritization process was quantitative and qualitative. Each strategy received a numerical score, but the team considered other factors, including:

- Which combination of strategies would yield a well-rounded program
- Which strategies could be applied across multiple product types to streamline program implementation
- Which strategies drew on the existing program's strengths

Program Enhancement Suggestions

The market research and process evaluation provided a clear identification of barriers and opportunities and the research team moved from this foundation using the process described above to generate three suggestions for enhancing the program activities for each product studied. In the case of refrigerators, the larger program goal was to increase sales of the most efficient units and the three suggestions (described in detail below) were to:

- Use incentives to reduce the incremental cost of efficient products and increase availability
- Improve retailers' ability to educate end-users about qualified products
- Increase retailer marketing of qualified products

Suggestion #1: Use End-User Incentives to Reduce Incremental Cost and Increase Availability

- Provide an incentive for products with a high incremental cost, and set the incentive amount to cover as much of the incremental cost as possible.
  - Initial research suggests the incentive should target the lowest-priced models (those under $750) and be close to $100 within cost-effectiveness requirements.
  - Consider conducting a more systematic study to identify other product types with high incremental cost, for example, among particular product configurations (the arrangement of refrigerator/freezer compartments and doors).
- Provide incentives to increase the availability of qualified models.
  - Provide incentives to brands (such as Brand X) to increase their offerings of low-priced ENERGY STAR models, i.e. Brand X does not manufacturer an ENERGY STAR product at the lowest price points - $399 and $499.
  - Provide incentives to retailers to shift their assortment to include a larger number of low-priced ENERGY STAR models. An assessment of top retailer websites showed the lowest availability of ENERGY STAR models at the lowest price points of under $500 and $500-750. Among refrigerators under $500, ENERGY STAR models made up 11% of models at Sears and 36% of models at Best Buy. Among refrigerators priced at $500-750, 50% of models at Sears and 53% of models at Best Buy were ENERGY STAR qualified. Above $750, 80-90% of models at both retailers were ENERGY STAR qualified.
- Consider offering end-user incentives for a limited-time, rather than year-round.
  - A limited-time incentive follows the model typically used by appliance retailers to generate sales and might reduce freeridership by opening alternatives for end-user self-reports when making attribution assessments. For example, European incentive programs are less common than U.S. programs and typically run for a limited period of time. Unit data tracked by GfK and presented at EEDAL 2011 showed that short-term “promotions” offer an approach to evaluating program impact using statistical analysis of difference in sales before, during, and after the incentive period. Figure 3 shows an example of the data provided by GfK for an Austrian efficiency program that promoted A++ refrigerators and freezers over two periods in Fall 2009 and Fall 2010, for four and three months respectively. The increase in market share of these models over their less efficient counterparts is clear from the bi-monthly and monthly sales data, and a “spillover” effect following the end of the promotion is also apparent.

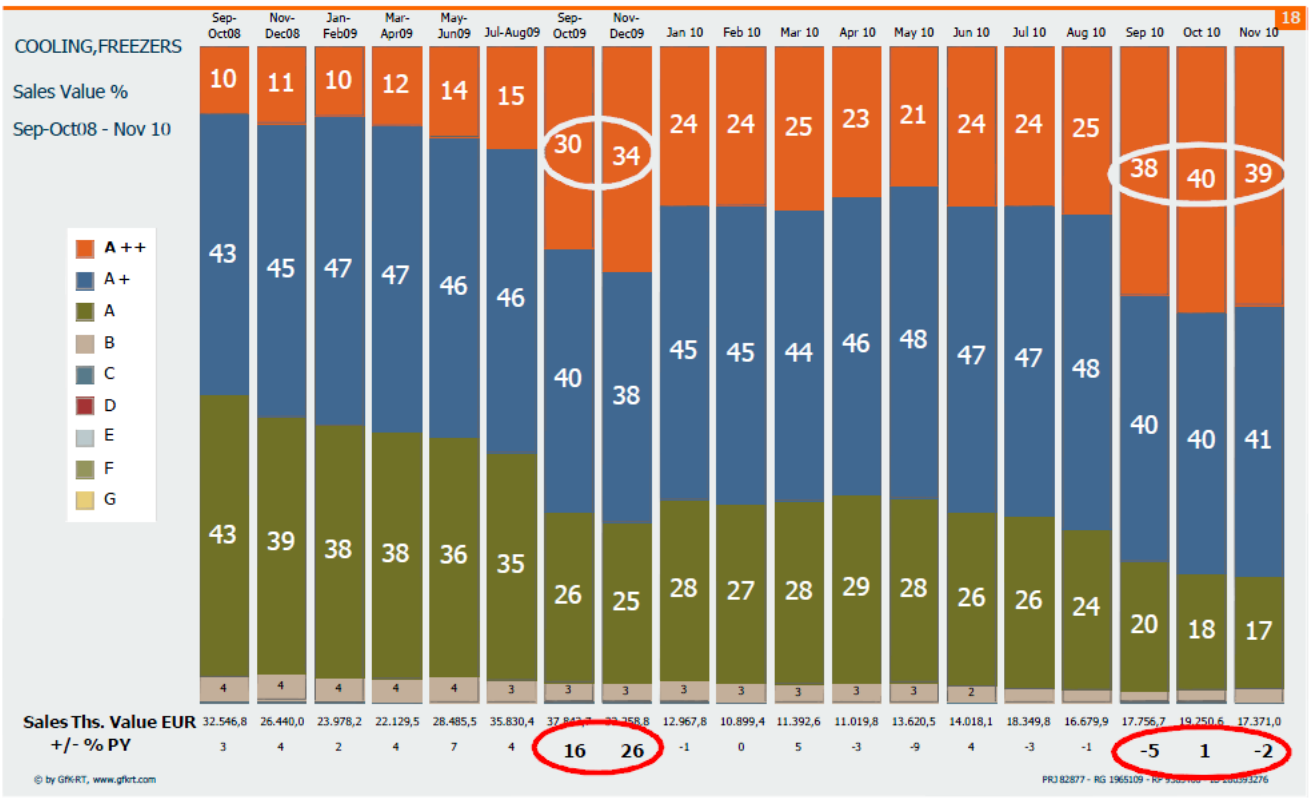

Figure 3. Share of A++ Cold Appliance Sales in Austria (2008 – 2010)

Source: GfK Retail and Technology Retail Audits

- Use experimental design pilots to identify the best implementation approach. Lacking data to suggest how a limited-time promotion might be most effectively structured, utilities should consider pilot programs to test various approaches and measure their relative uptake and costs.

Suggestion #2: Improve Retailers' Ability to Educate End Users About Qualified Products

- Develop a training program to help retail sales staff identify qualified products and explain their benefits to end users. Training with this focus addresses the barriers of low end-user awareness and the fact that energy efficiency is not a key purchase criterion. Market research showed widespread availability of qualified refrigerators at all but the lowest price points and low to no incremental cost differences between ENERGY STAR and baseline refrigerators. Thus, by increasing retailers' capability to educate customers, the program may be able to increase qualified product sales without offering a per-unit end-user incentive.

Increase Retailer Marketing of Qualified Products

- Institute a co-op marketing program to fund retailers for promoting qualified products. This recommendation leverages retailers' own expertise to increase end-user awareness of energy efficient products and increase sales.

Conclusions

As energy efficiency programs successfully reach their target markets and program objectives, the potential savings available to capture in a program is reduced. Further, as consumers become more knowledgeable about energy efficiency options, they tend to look for them; and thus, self-report methods become weaker tools for differentiating program effects from naturally occurring efficiency decisions. The integrated approach used in this project of a market characterization and a process evaluation was an effective tool for identifying new approaches for program design. The suggestions made by the research team, of course, must be reviewed and further analyzed by the utilities and then must meet regulatory approval. The market transformation approaches suggested by the research face challenges in the California regulatory environment where cost effectiveness and net savings requirements favor resource acquisition approaches.

The California IOUs are in the process of consolidating the HEER program with the other plug-load focused program for Business and Consumer Electronics. These programs are being combined under a broader residential program umbrella in recognition that smart chip-enabled appliances, other innovative behavior and feedback-based programs, including interim-home area networks (HAN) and full-HAN options, will influence all of these products in the future. The California IOUs work on the assumption that customer solutions need to be flexible so residential customers can implement efficiency options using either an incremental or a comprehensive investment approach. To make this affordable and accessible, the California IOUs and CPUC will also jointly explore a full range of financing and on-bill-repayment options in the 2013-2014 and beyond.

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