

The Revenue Neutral Sales Model: A New Approach to Estimating Lighting Program Free Ridership

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ABSTRACT

Lighting programs are a key component of many utilities' residential portfolios generating a large portion of overall program savings. Despite the importance of these programs, lighting program net-to-gross (NTG) estimates are plagued by uncertainty and can be highly contentious as a result. Most lighting programs are implemented in an upstream method where products are marked down at the point of purchase. These programs are more challenging to evaluate because they lack participant data. Existing evaluation methods are expensive, questionable in terms of their validity, and produce results that are unpredictable. In 2008, NTG ratios across several lighting programs ranged from 0.19 to 9.17. It is widely acknowledged that such sizable differences are not due to program design but rather the methods used to estimate NTG.

In this paper, we present a new and innovative method that uses existing data to estimate free ridership associated with upstream lighting programs. The Revenue Neutral Sales Model is based on an understanding of retailer behavior that underlies their participation in utility lighting programs.

In this paper, we outline the challenges associated with the evaluation of upstream lighting programs and weaknesses of current evaluation methods. We then discuss the theoretical underpinnings of the Revenue Neutral Sales Model. With the theory explained, we provide an example of the model in use in the evaluation of an actual lighting program. We finish with a discussion of the additional information provided by the model that is lacking from traditional lighting NTG methods including estimation of maximum free ridership by bulb type, retailer type, and during special promotional periods.

Introduction

Lighting programs are a key component of many utilities' residential portfolios generating a large portion of overall program savings. Despite the importance of these programs, lighting program net-to-gross (NTG) estimates are plagued by uncertainty and can be highly contentious as a result. Most lighting programs are implemented in an upstream method where products are marked down at the point of purchase. These programs are more challenging to evaluate because they lack participant data. Existing evaluation methods are expensive, questionable in terms of their validity, and produce results that are unpredictable. In 2008, NTG ratios across several lighting programs ranged from 0.19 to 9.17 (D&R International 2010). It is widely acknowledged that such sizable differences are not due to program design but rather the methods used to estimate NTG.

In this paper, we present a new and innovative method that uses existing data to estimate free ridership associated with upstream lighting programs. The Revenue Neutral Sales Model is based on an understanding of retailer behavior that underlies their participation in utility lighting programs.

When retailers participate in a utility lighting program, they reduce the price of energy efficient bulbs. If the discount does not spur enough additional sales, retailer gross revenue will drop. Utilities reimburse retailers for product discounts so their profits will not be impacted, but retailers still care about gross revenue because it influences investors, and corporate and store level bonuses are often tied to it. Retailers will avoid participating in utility lighting programs if the incentive levels and sales goals are insufficient to stimulate enough additional sales to make up revenue lost due to program discounts. In this paper, we outline the theory behind the model, present insight from corporate retail interviews, and present the results of the model used in an evaluation of a lighting program in Delaware.

Lighting Program Evaluation

The goal of upstream utility lighting programs is to increase the sales of energy efficient lighting in retail stores. The primary means of influence is by lowering the cost of efficient bulbs and educating customers about the benefits of efficient lighting. Utility lighting programs are typically implemented using an upstream markdown method in which energy efficient light bulbs and fixtures are automatically discounted at the point of sale. Customers “participate” by purchasing the discounted product at a retailer who has agreed to markdown the price of selected products. The point of sale system tracks the quantity of each product that customers purchase, and the utility reimburses the retailer for all purchases of qualifying products made during the promotional period.

Most utilities are required to estimate the percentage of the bulbs that that were sold with a program discount that would have been sold at regular retail price. That is, they must estimate program free ridership. Estimating lighting program free ridership is more challenging than other programs due to the upstream method of program implementation. Retailers’ point of sale systems do not collect customer information. As a result, evaluators are unable to contact customers who purchase program-discounted lighting after they leave the store. Most other utility programs collect participant information. For example, customers who participate in appliance rebate programs typically fill out a rebate application form. This program design allows evaluators to make use of the self-report method to estimate program NTG. Evaluators contact participants after their participation and ask them questions about their purchase decision, which they use to estimate program free ridership and spillover.¹

Ideally for lighting programs, retailers would provide program implementers and evaluators with sales information that would allow them to calculate the lift in sales due to the program. The type of sales data needed would depend on program longevity, but the number of bulbs sold at regular pricing without a program discount would be needed. For newer programs, full category sales information for sales before and after the program was implemented would be ideal. For longer running programs, the retailer could provide sales data for comparison areas that do not have programs, qualifying sales when the program turns discounts off, or sales of like products that are not discounted. Evaluators have asked but retailers typically refuse to provide non-program sales data.

Retailers are reluctant to share this type of information out of fear that it will fall into the hands of their competitors. While it may seem to be a relatively minor issue to the program sponsors, sales information provides insight into a competitor’s product mix, pricing strategy, sales volume and unit sales mix. These are all very useful in determining a merchandising strategy against competitors. This is the root of why retailers are often unwilling to provide pre-sales data. In some rare cases, retailers have provided non-program sales data but it was limited by retailer, product or time frame (D&R International 2012).

Without sales data, evaluators have attempted to use more traditional methods to estimate lighting program free ridership. A commonly used approach involves conducting a survey with a sample of a utility’s residential customers and asking questions of those who reported recently purchasing light bulbs. CFL purchasers are usually asked what type of lighting they would have hypothetically purchased if the bulbs they actually purchased had cost more. To answer this hypothetical question, the respondent must first (1) accurately recall purchasing CFLs, and (2) accurately recall the price paid.

Survey researchers are well aware of the errors associated with consumer expenditure surveys that ask people about their past purchases (Bradburn 2010). Accurately recalling a purchase and the amount paid is a difficult task, particularly for less salient items such as light bulbs. The Bureau of Labor Statistics’ (BLS)

¹ The self-report method has its own challenges and estimating NTG for these programs is not a simple task. These surveys need to be carefully constructed to avoid bias due to question wording and order (Buhr 2011). The algorithm used to combine the questions into a single point estimate is extremely important and can have tremendous influence on the result (Keating 2009).

Consumer Expenditure Survey (CES) is one of the most methodologically sound studies of its kind yet it still has known errors with simple purchase recall (Dillman 2012). If consumers struggle to accurately recall an *actual* past purchase, we should not expect them to answer a question about a *hypothetical* situation involving that purchase.

A related issue with these general population studies is that there is no way to ensure the bulbs purchased were discounted through the lighting program. The survey asks respondents where they purchased the bulbs. In addition to the recall error with this answer, evaluators must assume that any bulb purchased from a participating retailer was discounted through the program.

To address the weaknesses of this general population survey, evaluators have instead conducted in-store customer intercept interviews at participating retailers. The interview location ensures that the respondents are purchasing program-discounted lighting and the timing of the interview ensures that recall of the purchase is not an issue. However, the method has other weaknesses. In-store customer interviews typically make use of convenience samples. Evaluators attempt to conduct interviews in locations that represent the greatest percentage of bulbs sold through the program, but ultimately, they conduct interviews where and when they are allowed. Unfortunately, customer interviews conflicts with many retailers' corporate policies regarding outside solicitation so they do not allow the interviews to take place in their stores. They are also costly to conduct so evaluators can only conduct them over a few weekends during the program year, which is not representative of the entire year. Finally, intercepts are more expensive for utilities with large geographic territories, and evaluators may be forced to exclude some parts of the territory. It is possible that if the evaluator were to conduct another round of interviews in different retailers who are located in a different area at a different time, the resulting free ridership estimate would be different. With convenience samples like this, traditional sampling theory, which allows the calculation of confidence intervals, does not apply although some evaluators attempt to place confidence and precision levels around the resulting free ridership estimates.

The focus of the purchase, a light bulb, is still not a significant one for most customers. Customers consider a number of factors when making purchases, and, for low-cost items like light bulbs, it is not clear whether they can accurately self-report what they would hypothetically purchase if the bulbs cost a couple of dollars more. The self-report method likely produces more accurate results when it is used for more expensive and considered purchases.² There may also be greater social desirability bias in this circumstance. In a person-to person interview, people may not want to admit that an amount as little as \$1 would cause them to buy a product that uses more energy.

Due to the logistical difficulties and cost of in-store customer interviews, evaluators have used other methods to estimate lighting program free ridership. Evaluators have conducted interviews with retailers in which they asked retailers to provide sales information with and without the program. As we have already discussed, retailers do not usually provide sales data, which then causes evaluators to ask for estimates of the percentage increase in sales due to program discounts. Some retailers will provide broad responses that apply to all utility programs of this type but not a specific program. Very often, the free ridership estimates from retailer interviews end up based on the responses of a small number of retailers who provide these broad responses—neither valid nor representative of the area of the evaluation.

Finally, some evaluators have used advanced modeling techniques to estimate free ridership. Though these models are theoretically promising, they often make use of the same poor or incomplete data as other methods. One such model compared states with different levels of program longevity. Like the general population survey already discussed, the model included self-reported lighting purchase data and other

² The BLS CES provides some support for the greater accuracy of self-reported purchases of more expensive items. The survey is known to suffer from biases when compared to aggregate expenditure data though there is less error in the self-reported purchases of durable goods that cost more compared to less expensive non-durable goods (Garner, McClelland and Passero 2009).

variables. It is likely that these estimates suffered from a large amount of measurement error that resulted in NTG estimates that were plagued by wide error bounds (NMR Group, Inc. 2011).³ Another recent model estimates price elasticity using changes in program pricing over time. The model coefficients are used to estimate the quantity of bulbs that would be purchased at non-program pricing. The model has only sales of bulbs at different levels of program discounts so the range of the dependent variable, bulb sales, is truncated. As a result, the slope of the demand curve and resulting sales estimates are likely biased.

The weaknesses associated with the methods used to date to evaluate upstream lighting programs led us to pursue another method that makes use of the program data we do have. We also wanted to focus on the participants in upstream lighting programs who have made a considered choice to participate—retailers. In-store interviews with customers purchasing program-discounted bulbs often find that many do not know the bulbs are discounted. This does not mean the customers would pay full price, but they have not made a choice to participate in an energy efficiency program and therefore it may be difficult for them to answer detailed questions about their participation. Retailers, on the other hand, do choose to participate in the program, and will only do so under certain conditions. Those conditions provide the theory that underlies the Revenue Neutral Sales Model.

Model Theory

A retailer's total revenue, also known as "topline sales" due to its location at the top of a company's income statement, matters more to retailers than many realize. Profits, known as a company's bottom line since it is at the bottom of the income statement, are naturally also important. But revenue matters because outside the company, investors pay attention to revenue, while within the company, bonuses are often based on revenue. Profits are more important at the corporate level while revenue is more important to buyers and managers at lower levels.

From a profit perspective, retailers have little to worry about when participating in lighting programs. Because utilities reimburse retailers for the discounts, retailers' profits will not drop due to their participation in the program. In fact, their profits should increase because the drop in price of the bulbs will cause customers to purchase more than they would have at full price. Since the utility is paying for the discount, the retailer only needs to sell one additional bulb to increase its profits.

$$\textit{Profit} = \textit{Total Top Line Sales Revenue} - \textit{Total Costs} + \textit{Reimbursement}$$

However, retailers also care about revenues. A company's revenue is simply the number of units sold multiplied by the price per unit. While retailers' profits are protected when they participate in utility lighting programs, their total revenue is at risk because it does not include the reimbursement from the utility. Due to changes in generally accepted accounting principles (GAAP) necessitated by legislation such as Sarbanes-Oxley, retailers are only able to claim the actual sales price as "top line revenue". Reimbursement payments from utility programs can only be claimed as a reduction in the cost of goods sold, which is applied to the gross margin portion of the retailer's income statement. They cannot claim reimbursements in the top line of their income statements.

$$\textit{Total Top Line Sales Revenue} = \textit{Price} * \textit{Quantity Sold}$$

Retailers who participate in utility programs typically sign formal participation agreements with utilities in which they agree to provide discounts on select lighting products while the utility agrees to reimburse the retailer for the discounts. The participation agreements, often called memorandums of understanding (MOUs), identify the products the retailer will discount, the size of the discount, and the

³ For example, the multistate CFL model applied in Massachusetts produced a confidence interval that ranged from 0.45 to 1.45. Other states had similar results.

number of bulbs for which the utility will reimburse the retailer. A program that employs best practices will negotiate MOUs individually with multiple industry partners within a competitive framework.

A program that reduces the price of a product could cause revenues to drop if the quantity sold does not increase enough to cover the drop in price. Table 1 shows a hypothetical retailer’s profit and revenues for a product that sells for \$1 per bulb at regular price. At this price, the retailer sells 100 bulbs for a total revenue of \$100. The cost of the product to the retailer is \$0.50 giving the retailer a profit of \$50. Under a utility program that provides a 50% discount for the bulb, the bulb would cost \$0.50. If the retailer’s sales did not change and it still sold 100 bulbs, the retailer’s revenue would drop to \$50. However, the retailer’s profits would remain the same – the utility program discount covered the entire cost of the bulb to the retailer.

Table 1. Retail Profits and Revenues with and without an Upstream Lighting Program

	Regular Price	Program Pricing
Price of Product	\$1	\$0.50
Number Sold	100	100
Cost of Product to Retailer	\$0.50	\$0.50
Program Discount	na	\$0.50
Program Reimbursement	na	\$0.50
Revenue (Price * Number Sold)	\$100.00	\$50.00
Profit (Revenue – Cost + Reimbursement)	\$50.00	\$50.00

It is rare for sales to remain the same when the price of a product is lowered. After all, the purpose of utility discounts is to encourage increased sales of energy efficient lighting by reducing the price. The issue for the retailer is whether the size of the discount and the number of bulbs that the utility will reimburse is sufficient to make up for the revenue lost to the discount.

Table 2 provides another example of profit and revenue for the bulb that usually sells for \$1 and for \$0.50 after the utility discount. In this example, sales increase from 100 to 150 bulbs with the program discount. The retailer’s profits increase from \$50 to \$75 due to the increase in sales and the utility reimbursement for the discount, but the retailer’s revenue drops from \$100 to \$75 (compared to a drop in revenue to \$50 without sales lift as in the previous example). The retailer’s sales increased but not enough to cover the loss in revenue due to the discount. The retailer would have needed to sell 200 bulbs, or twice as many bulbs as it did without the program, for its revenues to remain the same.

Table 2. Retail Profits and Revenues with and without an Upstream Lighting Program

	Regular Price	Program Pricing
Price of Product	\$1	\$0.50
Number Sold	100	150
Cost of Product to Retailer	\$0.50	\$0.50
Program Discount	na	\$0.50
Program Reimbursement	na	\$0.50
Revenue (Price * Number Sold)	\$100.00	\$75.00
Profit (Revenue – Cost + Reimbursement)	\$50.00	\$75.00

It is important to understand the actual decision making process that the retailer uses when deciding to run any type of promotion for products in its stores. Calculating the impact of the promotion on revenues is standard practice for corporate level merchants and is applicable to non- utility promotions as well as

utility-sponsored promotions. During 2012 and 2013, we conducted interviews with the corporate staff of the largest retailers in the country who confirmed that they consider a program’s impact on revenue when reviewing and agreeing to an MOU. Major retailers have reported that potential loss of revenue is one of the biggest challenges of participating in upstream lighting programs, and it is important to structure the MOUs so that revenues do not decline. Corporate retailers have told us they will get complaints from the store level retailers and buyers if the MOUs are not structured in a manner to allow them to make up lost revenue. They monitor the program performance on a regular basis and make changes as necessary to avoid a decline in revenue from their participation.⁴

The retailer has access to the sales of units prior to any utility program. As part of the MOU evaluation process, our theory of retailer behavior says the retailer act in a predictable manner that is based on the revenue impact calculations. When making the decision to participate in the program, the retailer will determine the necessary increase in units sold at the discounted price to remain, at a minimum, revenue neutral.

Figure 1 displays the decision tree that retailers use when structuring lighting program MOUs. If the incentive levels and the number of bulbs the retailer is allowed to sell at the discounted price (also known as the allocation) will not generate enough sales to cover the lost revenue from the discount, the retailer will either decline to participate or renegotiate the MOU. If the retailer predicts that their revenues will remain the same or increase after the discount, the retailer will participate. If the retailer predicts that the program discount will have such a large impact on sales that their revenues would be more than the previous year but the allocation is set too low to allow it, the retailer may try to negotiate an increase in the allocation.

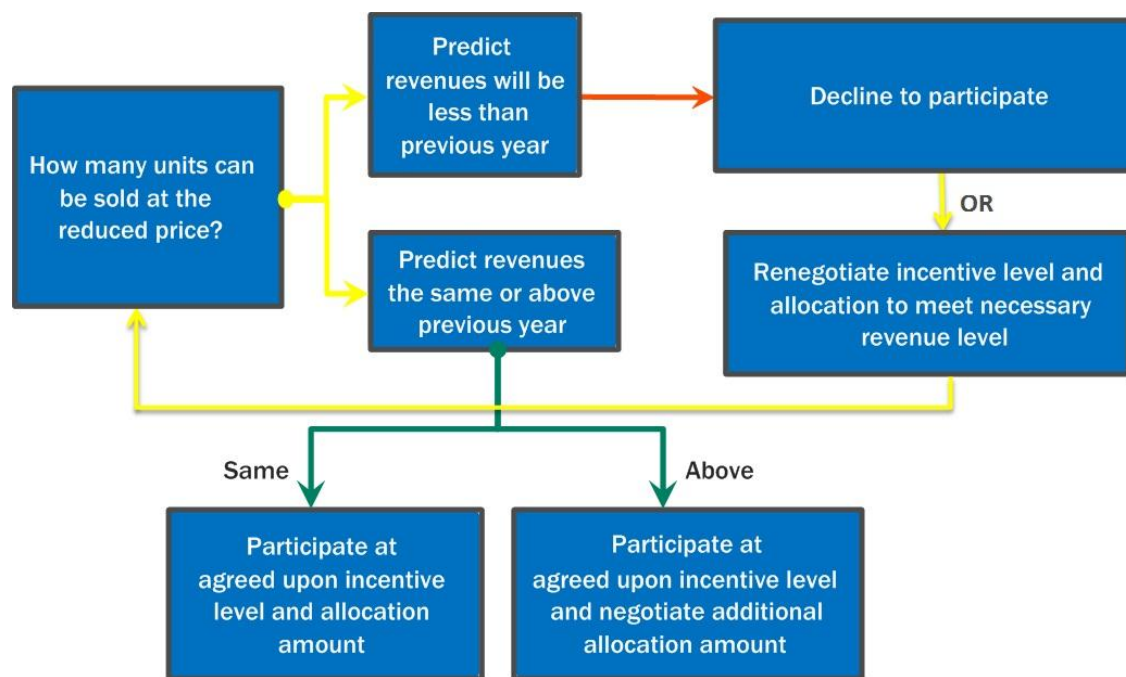


Figure 1. Retailer MOU Evaluation Process

⁴ At this time, retailers do not want to go on the record about the factors that influence product pricing and sales and their decision making regarding program participation with regard to revenue versus profits. In addition to our corporate interviews, one of the co-authors of this paper is a former regional buyer for the Home Depot and has over 30 years of experience in the retail environment. His experiences in this sector corroborate our retailer interviews.

Retailers have learned from their participation in lighting programs and have told us about changes they have made to their MOUs to protect their revenues. Some have limited the number and types of products they will discount because the price elasticity of some products is too low to make up the revenue loss due to the discount.⁵ Likewise, retailers have also limited the size of the discount they are willing to accept because they know that their sales will not increase enough to cover their revenue loss from a discount that large.

The goal of the Revenue Neutral Sales Model is to determine the number of units that the retailer would have sold in absence of the program. When the utility program does not have access to the actual sales of units prior to the beginning of the promotion, it must rely on the data points that it does have. The program does have access to the unit sales during the promotion time period and the negotiated MOU information about the regular retail price and the per unit incentive. Through a reverse calculation, the program can determine the number of units sold prior to the promotion based on the assumption that the retailer would participate in the program only if the program sales kept the retailer revenue neutral. This then allows for the establishment of a maximum free-ridership at the SKU level for a program. The model currently only considers the impact of price discounts and does not include other program features, which means actual free ridership could be lower than the model estimate. For example, during the year, the program may negotiate the placement of discounted bulbs on an end cap, which is known to increase sales. This will not be captured by the model, which is strictly based on the price and quantity needed to cover the lost revenue of the discount. In these cases, the model will overestimate free ridership. If sales during end cap placement and other promotions are tracked separately, we could incorporate the effects of these events in future versions of the model.

Model Implementation

One of the advantages of the Revenue Neutral Sales Model is that lighting program administrators can estimate a planning free ridership rate before the program year starts based just on information contained in the competitively negotiated MOUs. The MOUs contain information on the regular price of each product, the size of the discount, and the number of bulbs for which the utility will reimburse the retailer, also known as the allocation. We use the allocation to determine the number of discounted bulbs the retailer must sell to remain revenue neutral at the program-discounted pricing. From this, we can determine the number of bulbs the retailer would sell without the discount to have the same revenues. At the end of the year, we estimate the final program year free ridership by dividing the estimated number sold at regular pricing that we calculated for the planning free ridership by the number actually sold under the program.

Example

Consider a 4-pack of CFLs that regularly sells for \$5.85. The retailer signs an MOU with a utility and agrees to discount the product by \$4.00, lowering the retail price to \$1.85. The utility agrees to reimburse the retailer for discounts on up to 4,000 packages.

Table 3 shows the information we have before the program year starts and that we use to estimate a planning free ridership rate. The MOU does not contain revenue information but we can calculate it by multiplying the price by allocation. The revenue from the sale of the entire allocation of 4,000 packages at \$1.85 per package will be \$7,400.

⁵ The same discount for two products that are priced the same does not stimulate the same increase in sales for both products. Products that are more responsive to discounts are better candidates for inclusion because the sales lift is more likely to cover the revenue loss from the discount.

Table 3. Revenue Neutral Example: Information Available based on the MOU

	Price (P) = (R/Q)	Allocation (Q) = (R/P)	Expected Revenue (R) = (P*Q)
Without the Program	\$5.85	??	??
With the Program	\$1.85	4,000	\$7,400

We can fill in the missing quantities in Table 3 using the revenue neutral model. As shown in Table 4, we estimate the retailer’s revenue without the program by setting it equal to the revenue with the program. We estimate the quantity sold without the program by dividing the estimated revenue with the program by the price without the program giving us 1,265 packages. If the retailer sells all 4,000 bulbs allocated, the maximum free ridership rate will be 0.32 (FR=1265/4000).

Table 4. Revenue Neutral Example: Planning Results

	Price per Unit (P) = (R/Q)	Allocation (Q) = (R/P)	Expected Revenue (R) = (P*Q)
Without the Program	\$5.85	1,265	\$7,400
With the Program	\$1.85	4,000	\$7,400

Figure 2 graphically shows the planning free ridership based on the revenue neutral model. The model theory holds that revenues under the program must be at least equal to the revenue the retailer would have achieved without the program. To achieve revenue neutrality, the \$4.00 discount must induce and additional sales of 2,735 units, or 68% of the bulbs sold, which equates to a free ridership rate of 0.32.

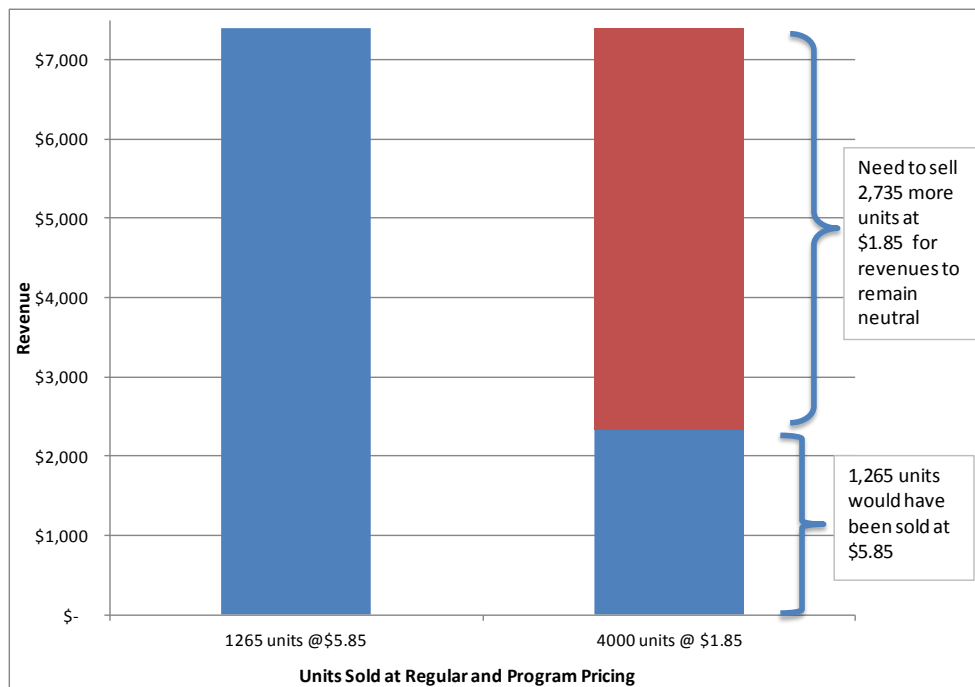


Figure 2. Program Planning Free Ridership

As the program is implemented, the retailer must provide proof of sales of all discounted bulbs to receive reimbursement. At the end of the year, the utility will know the actual number sold at the discount and not simply the number allocated. For this example, shown in Table 5, assume the retailer sold 3,800 bulbs, 200 short of the allocation. The final maximum free ridership rate on this product is 0.33 (FR=1265/3800).

Table 5. Revenue Neutral Example: End of the Year Results

	Price per Unit (P) = (R/Q)	Quantity Sold (Q) = (R/P)	Actual Revenue (R) = (P*Q)
Without the Program	\$5.85	1,265	\$7,400
With the Program	\$1.85	3,800	\$7,030

Even if the retailer does not sell the entire allocation, sales without the program would stay the same and the retailer would fall somewhat short of revenue neutrality on this product. Figure 3 shows this situation graphically. It is possible that the retailer will be disinclined to participate in the program in the next period or will seek to adjust the incentive levels on this particular product to achieve the pre-program revenue position. However, it is also important to keep in mind that retailers want to remain revenue neutral across all discounted products. It is not uncommon that retailers will sell less of one product and more of another than is planned for and allocated. The MOUs are based on the best predictions at the beginning of the year, but situations can change either in the retail environment itself or within the program. The next section provides results from an actual program and how the model adjusts when the program makes changes mid-year.

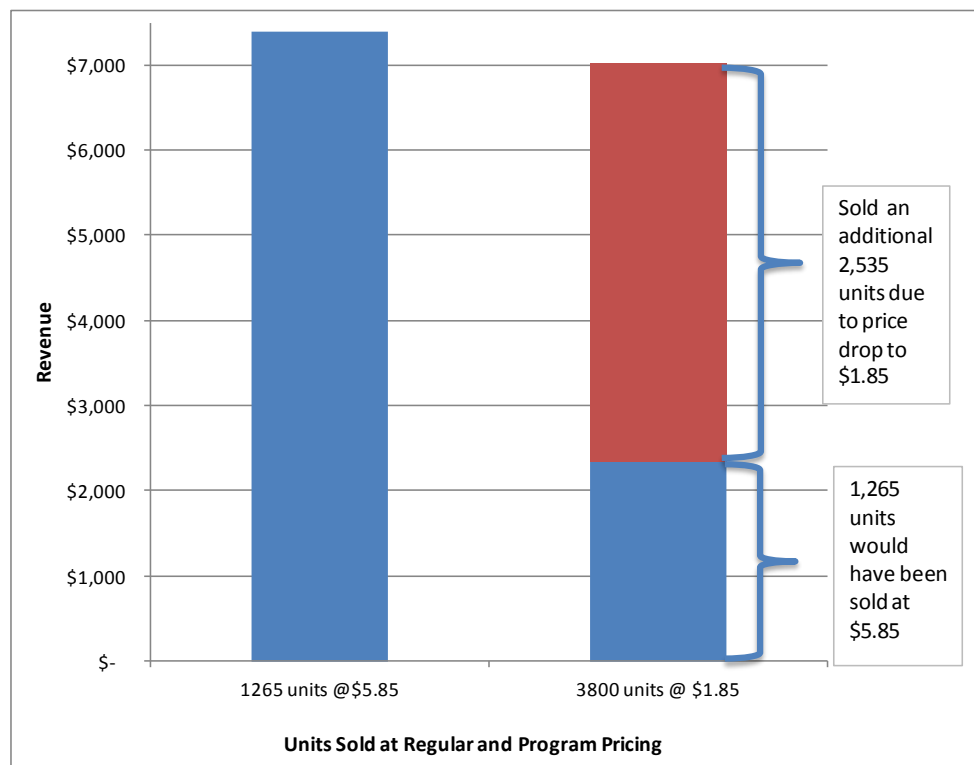


Figure 3. End of the Year Program Free Ridership

The Model in Practice

In the previous section, we outlined the theory behind the model and provided hypothetical examples for ease of explanation. In this section, we present the results of the model in practice. Opinion Dynamics used the model to estimate free ridership for a lighting program sponsored by the Delaware Department of Natural Resources and Environmental Control (DNREC) (Opinion Dynamics 2012). The program ran from July 2010 through August 2011 and provided discounts on the purchase of CFLs at 67 retail locations throughout the state. There were no upstream lighting programs in Delaware prior to this program.

Initially, the program's goal was to sell approximately 500,000 bulbs. Sales were higher than the program expected when it began. To keep the program within budget, the program either had to scale back the incentives, reduce the number of products it was selling at a discount, or cut the number of participating retailers. The implementer stopped providing discounts on the top-selling spiral CFLs in late 2010 and overall program sales dropped as expected. In the spring of 2011, the program received additional funds through the end of 2011 and raised the program allocation to approximately 1.3 million bulbs. The implementer reinstated discounts on the top-selling spiral CFLs but at a reduced rate so that sales remained below their initial level. Having sold close to 900,000 bulbs, the program ended in September 2011 for reasons unrelated to the lighting program performance. Figure 4 displays the weekly sales of discounted CFLs through the DNREC program and shows the clear impact of the program changes with three distinct sales levels.

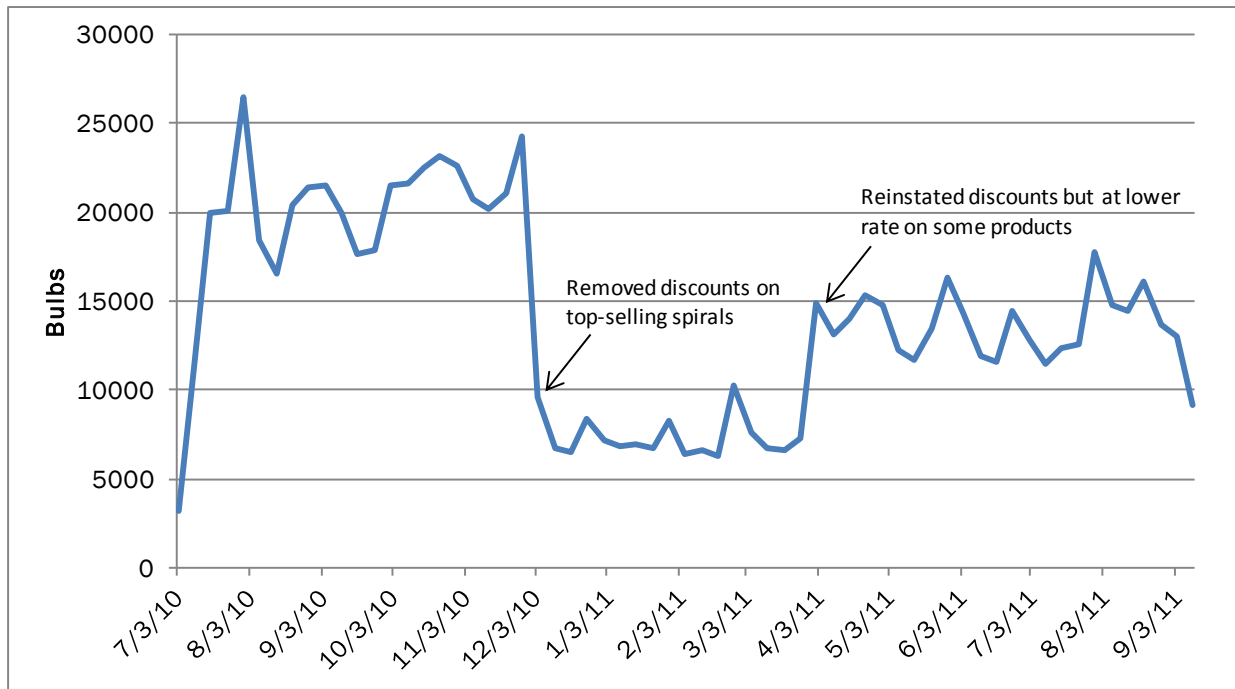


Figure 4. DNREC Residential Lighting Program: Weekly CFL Sales

The overall program free ridership based on the model results was 0.51. We calculated the free ridership rate for each of the pricing periods and found that free ridership was lowest during Period 1 when sales and discounts were the greatest and highest during Period 2 when the program stopped discounting the best-selling products. These products also had the lowest free ridership. By removing those products from the program and selling only products with higher free ridership, overall program free ridership rose during

this time. This example shows how the model can be used to tailor the program design to minimize free ridership.

Table 6. DNREC Residential Lighting Program Free Ridership

Program Period	Free Ridership
Overall	0.51
Period 1 (July – November 2010)	0.39
Period 2 (December 2010 – March 2011)	0.60
Period 3 (April – September 2011)	0.49

The model can easily produce separate free ridership estimates by bulb type or retailer. For DNREC, we estimated free ridership for standard versus specialty bulbs and found very similar rates, 0.51 for standard and 0.53 for specialty bulbs.

Conclusion

Estimating lighting program free ridership is challenging due to the upstream program delivery method. Evaluators have used methods that are not suitable for the program design such as general population surveys in which respondents must recall past purchases in great detail. Other methods such as in-store customer interviews are so expensive and difficult to conduct that evaluators are forced to use convenience samples.

The advantages of the Revenue Neutral Model over other methods are numerous. The model results are based on all retailers and sales from the entire program year and not a sample of sales or customers. The DNREC free ridership results varied over the program year when the program changed prices and product mixes. In-store intercepts are usually conducted over just a handful of days a year in a small number of retail locations. If the program changes its design at all over the course of the year, the intercept results may not reflect the entire program. Likewise, survey results can be subject to non-response error, and in the case of lighting purchases, measurement error.

Though the overall results are based on full program data, the model allows the evaluator to estimate a maximum level of free ridership for different retailer types, bulbs types, and during promotional periods. These results provide much more information about program performance and where it can be improved than other methods that often do not provide results at this level.

The method can also be used as a planning tool that program administrators can use in advance of the program to design programs that minimize free ridership and maximize program savings. The program can select products and set discounts that will produce the greatest lift in sales. If the program is well-designed and it meets its goals, the implementer will not have any surprises in terms of savings when the evaluator calculates a final free ridership based on actual program sales.

The model does require that program implementers provide detailed information from the MOUs, provide updates when those MOUs change during the year, and track their program sales in a way that can be tied back to the MOUs. If the program does not track all of the necessary information, there will be gaps in the data that will make it difficult to utilize and possibly produce invalid results. If the program tracks all the necessary information, the Revenue Neutral Model is a cost-effective evaluation and planning tool that provides an alternative to estimating lighting program free ridership and a level of results that other methods do not.

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