Evaluating Programs That Use Market Share As a Performance Metric

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ABSTRACT

In a recent paper the authors proposed that programs promoting energy-efficient measures (EEMs) should be viewed as efforts to market EEMs over their life cycle, and that increasing EEM market share is the most appropriate goal for such long-term programs. The authors left a major question associated with this proposal unanswered: is it feasible to evaluate programs that use market share as a performance goal?

To answer this question, the authors reviewed existing energy-efficiency studies that used market share as a performance indicator. The paper describes how market share has been used in actual energy-efficiency-program evaluations and other types of performance-monitoring studies. They found that some studies have substituted EEM saturation when the EEM's market share could not be reliably quantified. The authors use a logic model to show that saturation is a valid surrogate for market share in performance evaluations. The results show that (1) evaluators have developed either market share or saturation data for a large variety of EEMs and program areas; (2) efficiency-program evaluations using market share or saturation as performance indicators have only used market-based evaluation designs; and (3) programs using market share or saturation as implementation goals will probably need to be evaluated at the market level. They conclude that it is feasible to evaluate most programs having long-term market-share growth as their implementation goal.

Background and Purpose

The authors presented a paper at the 19th National Energy Services Conference in January 2009 in which they argued that energy-efficiency programs with implementation goals of either resource acquisition or market transformation, but not both, cannot adequately address today's social drivers (Barnes & Steigelmann 2009). We identified these social drivers as (1) high energy cost, (2) energy security, (3) energy reliability, and (4) climate change.

This perception arose because, as implementation contractors, we have been seeing requests for implementation proposals that claim to have both resource-acquisition and market-transformation goals but which require marketing tactics that are more appropriate to the resource-acquisition goal only.

Our paper argued that, (1) to address all of today's program drivers properly, the industry needs to treat resource-acquisition and market-transformation goals as simply phases of energy-efficiency measure (EEM) life-cycle marketing and (2) that the over-riding and long-term implementation goal for energy-efficiency programs should be the growth of EEM market share. We proposed that the energy-efficiency industry should make two adjustments to its current marketing approach to energy-efficiency programs. First, contemporary energy-efficiency programs should have the goal of increasing *and* sustaining the *market share* of energy-efficient measures. Second, the industry should plan on promoting this goal long-term, *over the lifetime of the energy-efficiency measures*.

[1] We want to thank our reviewers, especially Ralph Prahl, for their comments on earlier drafts. The opinions expressed in this paper are those of the authors and do not necessarily reflect those of the reviewers or of Lockheed Martin.

The earlier paper did not address a critical question associated with using market share as a goal: can one evaluate program performance when the goal is increased market share? This can be a significant concern because quantifying market share typically requires measuring sales in a program's entire market area, not just sales that are incentivized by the program. This paper addresses this question.

Use of Market Share and Saturation in Energy-Efficiency Program Studies

To answer the question, the authors reviewed how researchers have used market share in energy-efficiency program studies. We reviewed three types of studies: (1) program evaluations that used market share as an indicator of program impact; (2) program-monitoring reports that used market share as a metric for program progress (without estimating net impacts); and (3) reports that used market share for program planning purposes, e.g., to estimate the market potential for energy-efficient products.[2] Our research included reports from California, Massachusetts, New York, Vermont, Wisconsin, and the four states of the Pacific Northwest served by Northwest Energy Efficiency Alliance (NEEA) programs.[3] Additionally, we reviewed several relevant papers, including two papers that had already examined the quality and availability of EEM market-share data in the United States (Dimetrosky & Pascoe 2007; Dimetrosky, Bicknell & Titus 2007).

During this research, we found studies labeled as market-share studies that actually measured a mix of market share and *saturation* of energy-efficient measures (EEMs) (Aspen 2003). (We will define market share and saturation in the next section.) One study replaced EEM market share with EEM saturation when a low level of EEM sales made it unreasonable to measure market share (KEMA 2009). Several papers suggested making such a replacement when needed (Dimetrosky, Bicknell and Titus 2007; Cook 2008), and one paper strongly proposed replacing market share in CFL evaluations with CFL saturation (Kates 2005).

These findings led us to investigate the relationship between market share and saturation. We used program logic modeling methods for this. Figure 1 shows a generic logic model starting with program outputs and moving through the logical sequence of possible outcomes to the ultimate program outcomes—which in our case are the four social drivers mentioned in this paper's opening paragraph. Figure 1 shows the logic model used.

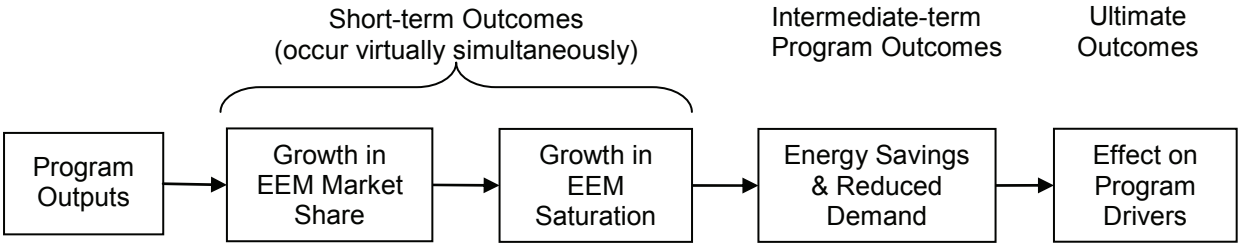

Figure 1. A Generic Program Logic Model Showing Desired Energy-efficiency Program Outcomes

The investigation led us to conclude that we were unreasonably limiting our efforts to market share. We decided that both of the short-term outcomes in Figure 1 are acceptable *evaluation* indicators of program performance even when the *operational* indicator is growth in market share. Therefore, we broadened our research to include studies measuring saturation. Simultaneously, we revised our research goals to assess:

[2] We restricted the studies reviewed to the year 2000 or later to examine more recent experience.
[3] The Reference section lists examples of the studies reviewed. The full list of studies reviewed is available from the authors.

- The availability of EEM market-share and saturation data
- Issues associated with EEM market-share and saturation data collection and data quality
- How EEM market share and saturation have been used in evaluations to attribute net energy savings and demand reduction to a program
- Issues associated with using EEM market share and saturation in impact evaluations.

Performance Indicator Definitions

We define our two evaluation indicators of program performance as follows:

Market Share

The market share (MS) for an EEM *x* sold in a geographic market *during a time period*, *Δt*, is:

$$MS_{x,\Delta t} = \frac{\text{(No. of units of EEM } x \text{ sold during } \Delta t)}{\text{(No. of all units of } X \text{ sold during } \Delta t)} \quad (1)$$

where *X* stands for all versions of a measure that perform the same function as EEM *x*. Time *Δt* can be a month, a quarter, a year, or any time duration of interest. This definition can also be expressed as a percentage by multiplying definition (1) by 100.

The U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) use the term "market penetration" to label what we define as "market share." The Consortium for Energy Efficiency recommends the use of "market penetration" in lieu of "market share" (Dimetrosky 2007). However, the term "market penetration" has other meanings in certain utility and innovation-of-diffusion research, and "market share" is consistent with the emphasis in our earlier paper on the value of traditional marketing concepts. Therefore, we have chosen to use the term.[4]

Saturation, or Technology Saturation

Saturation (SAT) is the average number of EEM *x* per customer *at a specific point in time*, *t*.

$$SAT_{x,t} = \frac{\text{(No. of EEM } x \text{ installed by customers at } t)}{\text{(No. of all customers at } t)} \quad (2)$$

This definition can also be expressed as a percentage by multiplying definition (2) by 100. Saturation can be expressed in terms of *feasible opportunities* for installation by replacing the denominator in (2) with a count of all such feasible opportunities. This could be particularly useful when using the saturation of compact fluorescent light bulbs (CFLs) as an evaluation indicator.

Definition (2) specifies that the EEM be *installed*. When defined in this way, saturation may be superior to market share as an indicator of long-term energy-efficiency programs' contributions to the four social drivers because it does not include EEMs, e.g. CFLs, purchased for storage or that have failed to persist in usage.

[4] The term "market share" has also been used to label the fraction of an entire market's total sales achieved by a particular brand or retailer. We recommend that the term be clearly defined in each study using it.

Availability of Market-Share and Saturation Data for Evaluation

Tables 1 and 2 summarize the research into data availability conducted for this paper. The two tables also illustrate the availability of market-share and saturation data using (1) examples of studies that have used these data and (2) sources available to evaluators.[5] The next section of the paper summarizes the issues currently associated with these data.

Table 1: Examples of Studies Using Residential EEM Market Share, EEM Sales, or Saturation Data Plus Data Sources Available to Evaluators, by EEM

Sector and EEMs for Which Available	Data, Secondary or Primary Source, and Compiler	Level(s) for which Data Collected	Time Period(s) for which Data Collected	References (Sources or Examples of Measurements)
RESIDENTIAL SECTOR				
MARKET SHARE (MS) OR SALES DATA				
Secondary Data Sources				*All Web URLs accessed May-June 2009*
Refrigerators. Dishwashers. Clothes washers. Room air conditioners.	Nat'l ENERGY STAR® retail chain store partners' MS self-report+other sources. Compiled by D&R International.	U.S.; region; state.	Annual; quarter.	www.energystar.gov/index.cfm?c=manuf_res.pt_appliances
		CA program areas	Calendar year	Itron 2006
13 product categories, e.g., boilers, heat pumps, central air conditioners, electronic products, lighting fixtures	MS & total product shipments: National ENERGY STAR mfr partners + other sources. Compiled by ICF Int'l.	U.S.	Annual since 2003.	www.energystar.gov/index.cfm?c=pt_reps_res_retail.pt_reps_res_retail
Compact fluorescent light bulbs (CFLs)	Barcode scanner sales data: AC Nielsen: grocery stores, drug stores, and mass merchandisers. Activant: hardware & some HI retailers. Compiled by Itron.	U.S., major regions, Metropolitan Statistical Areas (MSAs).	Annual. Excludes Major home improvement (HI) retail chains after 2003.	Itron 2008. Since 1/1/07 AC Nielsen has compiled total CFL shipments for the 18seconds Web site since 1/1/07. http://green.yahoo.com/18seconds/
CFLs	ENERGY STAR sales self-reported by 6 major national retailers. Compiled by Cadmus.	U.S.; state; MSAs (by ZIP Code).	Quarterly (Qtr 1, 2007 available).	www.energystar.gov/index.cfm?c=pt_reps_res_retail.pt_reps_res_retail
Windows	ENERGY STAR MS	U.S.; Ducker Research regions.	Annual: 2001-2005. 2007.	www.energystar.gov/ia/partners/manuf_res/window/windows_PRG.pdf www.energystar.gov/ia/partners/prod_development/archives/downloads/windows_doors/DandR-MarketPenetrationRats.pdf

(Continued)

[5] Other sources were identified, e.g., for unitary air conditioners, but they have not been used in any study reviewed for this paper or are believed to be unavailable to evaluators at this time. For more on these sources and the issues associated with market-share data, see Dimetrosky 2007.

Sector and EEMs for Which Available	Data, Secondary or Primary Source, and Compiler	Level(s) for which Data Collected	Time Period(s) for which Data Collected	References (Sources or Examples of Measurements)
RESIDENTIAL SECTOR				
MARKET SHARE (MS) OR SALES DATA				
	Primary Data Sources			
Appliances CFLs Lighting fixtures Torchieres	Appl. retailer program partners' self-report of EEM and total sales. Compiled by program administrator.	Program area. (NYSERDA) State. (WI)	Depends on partner agreement; often monthly.	Lockheed Martin (monthly since 2000). (NYSERDA) Glacier 2008. (WI) (CFLs)
Electronic products	Household MS by survey, mail or telephone.	Program area. (NYSERDA) State. (WI)	Program year.	Aspen 2002. (NYSERDA). Glacier 2008. (WI) (CFLs).
SATURATION DATA				
	Secondary Data Sources			*All Web URLs accessed May-June 2009*
Refrigerators. Clothes washers. Programmable thermostat.	Residential Energy Consumption Survey micro data. On-site survey. Compiled by EIA.	U.S., Census region, Census division	2005; collected every four years.	www.eia.doe.gov/emeu/recs/contents.html (accessed May 1, 2009)
	Primary Data Sources			
Refrigerators. Dishwashers. Clothes washers. Room air conditioners. CFLS & light fixtures.	On-site survey.	State. (ME)	2007.	Lockheed Martin 2007.
CFLs	Telephone survey with on-site verifications.	State. (MA)	2007.	NMR 2008.
	Telephone survey with on-site verifications.	State. (MA)	2003, 2004.	Kates 2005.

Table 2: Examples of Studies Using Commercial and Industrial EEM Market Share, EEM Sales, or Saturation Data Plus Data Sources Available to Evaluators, by EEM

Sector and EEMs for Which Available	Data, Secondary or Primary Source, and Compiler	Level(s) for which Data Collected	Time Period(s) for which Data Collected	References (Sources or Examples of Measurements)
COMMERCIAL & INDUSTRIAL SECTORS				
MARKET SHARE (MS) OR SALES DATA				
	Secondary Data Sources			*All Web URLs accessed May-June 2009*
Fryers & steamers. Hot food cabinets. Refrigerators & freezers Exit signs. Light HVAC. Roof products.	MS & total product shipments: Nat'l ENERGY STAR manufacturer partners + other sources. Compiled by ICF Int'l.	U.S.	Annual.	www.energystar.gov/index.cfm?c=pt_reps_res_retail.pt_reps_res_retail
	Primary Data Sources			
High bay fluorescent lighting	Telephone survey of lighting installation contractors.	Program (WI) & comparison (MI) areas.	2008; first of planned two surveys.	KEMA 2009.
High efficiency rooftop AC units	Telephone survey of HVAC distributors.	Program (WI) & comparison (MI) areas.	2008; first of planned two surveys.	KEMA 2009.

(Continued)

Sector and EEMs for Which Available	Data, Secondary or Primary Source, and Compiler	Level(s) for which Data Collected	Time Period(s) for which Data Collected	References (Sources or Examples of Measurements)
COMMERCIAL & INDUSTRIAL SECTORS				
VFD controlled compressed air systems, industrial pumps, and fans.	Telephone survey of industrial end-users.	Program (WI) & comparison (MI) areas.	2008; first of planned two surveys.	KEMA 2009. (Also collected saturation data on these EEMs.
Premium efficiency motors.	On-site survey of industrial end-users	State. (CA)	2001-2003; one-time survey.	Aspen 2003.
SATURATION DATA				
Secondary Data Sources				*All Web URLs accessed May-June 2009*
Regular HVAC maintenance. Energy mgmt & control system. Pcnt space lit by CFLs.	Commercial Buildings Energy Consumption Survey micro data. On-site survey. Compiled by EIA.	U.S., Census region, Census division	2005; collected every four years.	www.eia.doe.gov/emeu/cbecs/contents.html
Primary Data Sources				
Air compressor throttling controls & VFDs. Compressed air systems leak maintenance. Electronic controls to shut off unused equipment.	Telephone survey of industrial end-users.	State. (CA)	2003; one-time survey.	Aspen 2003.
VFD controlled compressed air systems, industrial pumps, and fans.	Telephone survey of industrial end-users.	Program (WI) & comparison (MI) areas.	2008; first of planned two surveys.	KEMA 2009. (Also collected market-share data on these EEMs.)

Strengths and Weaknesses in Market Share and Saturation Indicator Data

This section reviews the issues associated with the market-share and saturation data identified in Tables 1 and 2 in terms of the ability to obtain the desired geographic focus, sector and EEM coverage, data quality, and the cost of the data.

Geographic Focus.

Secondary market-share data are available at the national and state levels for many residential appliances and, with assumptions and imputations, CFLs and windows. State-level data may be adjusted to large utility areas with proxies such as sales per household. The two review papers cited earlier discuss the many assumptions required to create geographically specific market shares from existing secondary data. **Primary market-share and saturation** data can be developed at any geographic level, subject to the caveats described in the following subsections. Primary market-share data can also be collected from retailers and suppliers at the program-area level when a program can persuade them to provide it.

Sector Coverage.

Secondary market-share data are available for many residential appliances, and, with a number of assumptions, residential CFLs, lighting fixtures, and windows. Several reports reviewed commented on the difficulty of obtaining secondary market share data for commercial and industrial (C&I) EEMs. At present, only total shipment data are available for several commercial EEMs; market shares must be developed by combining primary research data with the secondary shipment data using a number of

assumptions. **Primary market-share data** may be collected by either telephone, on-site surveys, or surveys of upstream suppliers in any sector; however, the evaluator may encounter difficulty in (1) developing reliable sample frames for C&I end-users in a specific program area without cooperation from a distribution utility, and (2) gaining access for surveys, especially on-site surveys, from non-participants and respondents in comparison areas.

Secondary saturation data are available for a very limited number of EEMs in both the residential and commercial buildings sectors from the U.S. Energy Information Administration's (EIA's) Residential Energy Consumption (RECS) and Commercial Building Energy Consumption Surveys (CBECS).

EEM Coverage

Secondary market share data have been developed for the EEMs listed in Tables 1 and 2; however, they are not available to evaluators at program-specific levels without assumptions and imputations. **Primary market share data** can be developed for virtually any EEM. EEM market share data are not relevant to behavioral EEMs such as building commissioning.

Secondary saturation data, with one exception, at this time are available only for the EEMs measured through the EIA's RECS and CBECS. The exception consists of using results that have been reported by another program evaluation as a baseline for a subsequent evaluation. **Primary saturation data** appears to have few EEM limitations. Even behavioral EEMs can be measured as saturations. This is a strength of using primary data to measure saturation. Limitations include the ability to gain access to an end-user site for measurement.

Quality

Secondary market share data suffer from several issues**.** The two review papers cited earlier include discussions of the many quality issues. For example, DOE cautions that "direct comparisons from year to year should not be made" because the retailers that report its ENERGY STAR appliance market-share data occasionally change leading to discontinuities in trend data. Suppliers may not distinguish multipack CFL sales from single bulb sales. **Primary market share data** is subject to errors in respondent recall of the EEM purchase date for and knowledge of its true efficiency status. Residential phone surveys that require end users to identify whether he or she has purchased an efficient product have been shown to produce erroneous results compared to on-site surveys (Dimetrosky, Bicknell & Titus 2007). Even with on-site surveys, it is sometimes difficult to establish whether the EEM is, in fact, an efficient model or when it was purchased. Other studies have shown that appliance and CFL market shares measured by different methods for the same market and time period can be very different (SERA 2004; Kates 2005). Apart from understanding why the differences occurred, these studies indicate that the same method should be used for time-series data collection. Strengths of primary market-share data collection include the evaluator's control of confidence interval and surveyor training.

Secondary saturation data, at present are available only from RECS and CBECS. These two sources have well-documented sampling and data collection methods and can be presumed to have good quality. **Primary saturation data**, if collected by phone, suffer from the issue of establishing which EEMs are, in fact, efficient. The ability to actually see and count the equipment is a significant advantage. For EEMs that are installed in large numbers, e.g., office lighting, counting time will add to the cost. As with primary market-share data collection, strengths of primary saturation data collection include the evaluator's control of confidence interval and surveyor training.

Cost

Secondary market-share data often are the least expensive. For some residential appliance EEMs, secondary market-share data are free. **Primary market-share data** for any sector entail the cost of telephone or on-site surveys, which can be significant.

Secondary Saturation Data exist only in the RECS and CBECS micro-data sets and are free. The cost of **primary saturation data** collection can be a major barrier to its use. The cost of on-site vs. telephone saturation data collection will vary by EEM and sample size. The cost of primary data collection by phone will be comparable to that for market-share data. Many factors affect the cost of on-site data collection, but the authors estimate from personal experience with a residential saturation survey that an on-site saturation survey can be two to three times more expensive than a telephone survey for the same data with the same confidence interval. One possible method of controlling the cost of primary saturation data collection would be to conduct the evaluations less frequently, e.g., every three years.

Evaluation Research Designs and Attribution Methods Using Market Share

Figure 2 illustrates the two basic evaluation designs currently used by most energy-efficiency evaluators. It illustrates our description of the designs and methods that have been used with market-share (MS) and saturation (S) attribution evaluations. We borrow the labels, "Market-based" and "Self-reported program response," from Wisconsin's Focus on Energy Evaluation Team to label the two designs (Focus 2008).

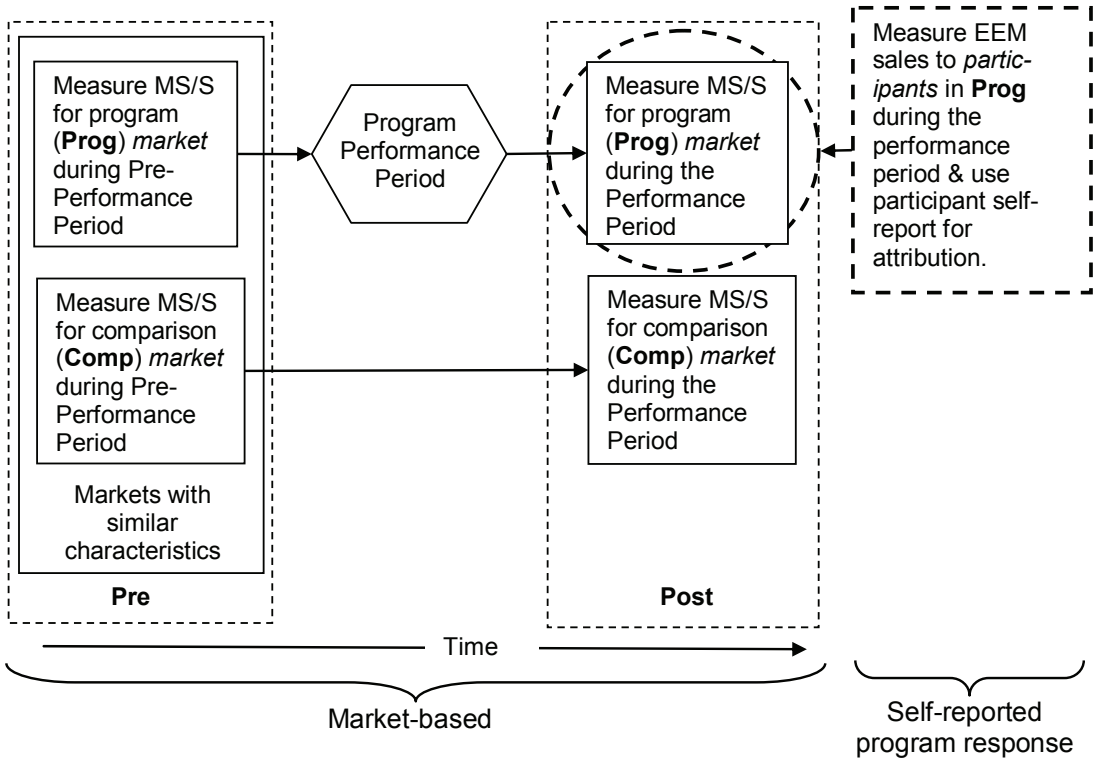

Figure 2: Market-based and Self-reported Program Response Evaluation Research Designs

Energy-efficiency program evaluators working with market share and saturation have used four combinations of research design and analytical method to attribute outcomes to programs.

1. Comparison of **Pre-/Post** Differences in MS/S between **Prog** and **Comp** Markets (KEMA 2009[6]). These evaluations measured the change in market share of EEM *x* in a geographic market exposed to the program (**Prog**) and in a geographic market with similar characteristics that is presumed to be not exposed to any program (**Comp**).[7] The net impact of the program on the market share for *x* is:

   NetMS(**Prog**) = [MS(**Prog**) **Post –** MS(**Prog**) **Pre**] – [MS(**Comp**) **Post –** M(**Comp**) **Pre**]. (3)

   Multiply this difference by the total sales to estimate net sales. The *total* sales value used to calculate attributable sales is usually the post-program sales for the program's market area.

2. Use of Regression Analysis to Calculate **Pre-/Post** Differences in MS/S between **Prog** and **Comp** Markets (NMR 2005). This evaluation incorporated the **Pre/Post-** MS measurements for both **Prog** and **Comp** into a regression model using as the dependent variable a time series of changes in MS for ENERGY STAR appliances. The model includes a set of explanatory independent variables to account for external influences on market share that might not be adequately "controlled" by the program-/comparison-market match. The net impact of the program on the change in market share for EEM *x* is the coefficient of the program variable in the regression model. This change in market share is multiplied by total sales to estimate the net EEM sales, as described under design #1 above.

3. Comparison of **Post**-only Differences in MS/S between **Prog** and **Comp** Markets (Rosenberg 2003, Glacier 2008, NMR 2008). This evaluation design has been used to measure the difference in market share between a **Prog** market and an unmatched **Comp** market at the end of a program period. The net impact of the program on market share in **Prog**, using this approach, is:

   NetMS(**Prog**) = MS(**Prog**) **Post –** MS(**Comp**) **Post** (4)

   This design has used either direct **Prog/Comp** comparison of MS or regression modeling to estimate the program's impact on MS. The design does not account for the pre-program MS or changes in the market that may have influenced **Comp** measurement between the **Pre** and **Post** markets; however, large differences in MS between **Prog** and **Comp** measurements may provide acceptable evidence of impact. The second example provided a partial adjustment for differences in the **Prog** and **Comp** markets by using sales per household as the performance indicator.[8]

4. Comparison of **Post**-only Differences in MS/S between **Prog** and **Comp** Markets with MS Measurements supplemented by Upstream **Prog** Participants' Self-Reports and Other Data (Quantec 2007).[9] Several variants of this design were observed. The example cited was a CFL program evaluation. It first estimated **post**-only market share in the program territory, then adjusted it for retailers' opinions and converted it to average sales per household using several external sources of total sales data. The evaluation then estimated **post**-only sales per household in no-program **comp** states as a baseline. The **post**-only **prog** and **comp** sales per household estimates were compared to develop net sales in the program territory.

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[6] This example measured the **Prog Pre** and **Comp Pre** market shares and saturations for certain C&I EEMs to establish a baseline for a future measurement of the **Prog Post** and **Comp Post** market shares in approximately three years.

[7] In practice, the matching variables used to select the similar comparison market area for these designs have included median income, average education, renter vs. owner adjusted to the market area, population center distribution (urban/suburban/rural) from U.S. Census data; and energy price and climate zone.

[8] We treat average sales per household is a variant on market share. Like market share, it accumulates sales over a period of time.

[9] Some examples were identified that also used comparison-group upstream self-reports.

Strengths and Weaknesses in Impact Evaluation Designs Using Market Share

Time Series Data. Evaluation designs #1 and #2 require a market-share time series of at least two program periods. However, secondary market-share time series data were found only for appliances and CFLs. Secondary saturation trend data for those EEMs covered by RECS and CBECS may someday exist; however, these surveys are conducted once in four years. A time series may be established through primary data collection, but it will require at least two periods of consistent data collection to do so.

State Regulatory Issues. All of the market-share evaluation designs found are market-based. As such they account for *all* influences on the program- and comparison-area markets during the program performance period. This means that participant-specific findings cannot be separately quantified because they are undifferentiated parts of the entire area market. The sales or saturation in the comparison area accounts for free-ridership, spillover, market-effects, and leakage. Evaluators will not be able to use these designs in program jurisdictions whose regulatory authorities require quantified free-ridership or spillover factors.

Geographic Focus. The principal geographic issue for market-based evaluation designs is finding a jurisdiction that has never experienced an efficiency program of the type being evaluated. As time goes on, fewer of these will be available. Regions in the South benefiting from relatively low Tennessee Valley Authority electric rates may persist in avoiding efficiency programs; however, use of these would seem to require that evaluators apply a regression method for market share evaluation in order to account for energy-price and other group differences.

Sector Coverage. The principal issues for sector coverage are the sector data-availability issues.

EEM Coverage. From an evaluation-design perspective the only EEM-related limitation is the irrelevance of market-share for behavioral EEMs. Saturation data can include behavioral EEMs.

Quality. The requirements of internal and external validity constitute the principal quality issues in the design of an evaluation. External validity, or the defensibility of inferring the results of the evaluation to other populations, does not appear to be an issue because evaluators are only interested in the program jurisdiction they are evaluating, not other jurisdictions. Internal validity, or the question of whether the evaluation is really measuring what it purports to measure, is a concern for all evaluations. It is virtually impossible to control all of the threats to internal validity in an energy-efficiency program evaluation. However, if the comparison group is at least partially matched, use of an additional set of independent regression variables may account for many of the remaining differences such that the results may be acceptable from an internal validity perspective.

Cost. In the absence of inexpensive secondary data, the need to collect primary data from a comparison market will usually make market-based evaluation designs more expensive than self-reported program response designs. Use of on-site data-collection for saturation studies will aggravate the cost issue.

A Special Issue for Mature Programs. As market share peaks during a mature product's life cycle, the *change* in market share from year to year will decrease. Therefore, if a geographic area with no program activity serves as the comparison area for an impact evaluation of a mature program, evaluation designs #1 and #2, pose a risk that the evaluation of the mature program will show very little pre-/post- change relative to the comparison market. However, if the market share of an EEM promoted by a mature program is high and reaching its peak, further program activity may, indeed, not be warranted.

Summary and Conclusions

The authors set out to determine whether it was feasible to evaluate programs whose principal implementation goal is to increase EEM market share, and if so, how it could be done. We examined data availability and evaluation designs that have been used for existing market-share evaluations. With respect to data availability, secondary market-share data are available, or can be developed, for residential programs promoting ENERGY STAR appliances, CFLs, and ENERGY STAR light fixtures; however, the evaluator can expect to need a number of assumptions, imputations, and supplementary data. Currently, very little useful secondary data are available for the commercial and industrial sectors. Very little secondary EEM saturation data are available for any sector.

Primary market share and saturation data may be obtained by telephone or on-site survey for virtually any EEM and program area if the evaluator is willing to accept the cost of data collection and possible uncertainties regarding purchase date and/or knowledge of which models are efficient. If time-series data are to be used, they should be collected by the same method for each time period. Primary saturation data appears to offer advantages as an evaluation indicator for long-term programs whose implementation goal is the growth of market share. Its cost disadvantage might be overcome by conducting surveys to quantify a net-to-gross ratio (NTGR) less frequently, e.g., every three program years. The resulting NTGR could be used during the interim years.

With respect to evaluation designs and methods, market-based evaluation designs appear to be the most appropriate design for evaluating programs with a market-share implementation goal.

We conclude that it is feasible to evaluate market-share growth as an implementation goal for long-term energy-efficiency programs promoting virtually any EEM.

References

The references cited in this paper are classified into the four types described in the paper. Several fit more than one type. We list them in the type that we judged best matches their content.

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