Methods and Measurement Issues for a DSM Evaluation versus a MT Market Assessment and Baseline Study

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ABSTRACT

The basic research techniques used in DSM evaluations are also used in MT studies: surveys, and interviews. But the focus of what to ask and who to ask is quite different. Knowing these differences and their consequences for the research and sampling design can help the evaluator learn from their prior DSM evaluation work and more easily transition to conducting market transformation studies. This paper presents comparisons between DSM evaluation, and MT market assessment and baseline studies to provide a starting point for those making this transition. The comparisons are from a market assessment and baseline study of the residential gas heating equipment market for the Boston Gas Company and an impact and process evaluation of Boston Gas Company's Low-Income Energy Savings Program. This paper also presents a brief list of guidelines for market transformation (MT) measurement.

Overview of the Philosophical Shift from DSM to MT Efforts

Regulation of gas and electric utilities in the United States and Canada incorporated investing in energy efficiency in the 1970's through 1990's, first as a response to fear of fossil fuel shortages, then national security, least cost utility planning (comparing supply-side to demand-side options), and lately due to adverse environmental impacts of energy usage and production. Associated with these changing perspectives was the movement from examining the costs of energy provision from the viewpoint of the utility to a broader view of the overall costs to society.

The framework for these regulatory directions took place in a largely vertically integrated utility industry with strong state/provincial regulatory review. The energy efficiency investments were made as part of a philosophy of low cost resource acquisition (least cost planning and demand-side management (DSM) in place of acquiring additional supply resources). This became part of the planning process of resource acquisition in the 1980's, known as Integrated Resource Planning (IRP) framework.

As changes in regulation (deregulation) and industry restructuring has occurred in the 1990's, the supply acquisition framework has been changing to a less vertically integrated industry. In many U.S. states and foreign countries, the supply/power generation portion of utilities has been deregulated. The remaining regulation is more focused upon the transmission and distribution element of energy provision. The IRP model, that focused on least cost planning for new supply and demand-side resources, no longer fits well in a distribution-only framework. Nevertheless, policy-makers still see positive societal and environmental benefits of energy efficiency.

Generally, the societal benefits are seen as warranting utility funds (often a surcharge or a non-by-passable wires charge on the utility bill to fund efficiency programs). Rather than purchasing resources in the form of energy saved ("negawatts") as in the long-term planning perspective of IRP, the impetus is to encourage the development of energy efficiency and the reduction of market barriers in order to avoid societal costs in terms of negative environmental impacts.

An important step in the process in California was the adoption of the philosophy that the justification for intervention in these markets was that the market did not operate efficiently to produce the energy efficiency levels that appear cost-effective for customers to choose.[1] This created the backdrop for work on the barriers in the markets that were not allowing these more efficient technologies and/or services to be more widely adopted. An oft-cited study examined the issue of market barriers and market transformation in the field of energy efficiency based upon many of the concepts from transaction cost economics, referred to as the Scoping Study.[2]

The philosophy of market transformation (MT) efforts is to use innovative initiatives to assist in permanently changing markets so that energy-efficiency can be obtained at the lowest cost and with reduced long-term utility intervention and subsidization. Sustainable markets that allow for adoption of energy efficiency at a level commensurate with its benefits are expected to be achieved once there are no market barriers in the way of this demand or of its supply.

The long-term perspective of market transformation holds with it the hope that it may be much more cost-effective in the long-run than the resource acquisition (prior DSM) perspective. As MT efforts begin to work, the market itself begins to increase the adoption of energy efficiency and increase energy savings. A self-sustaining market that is transformed to include large penetrations of energy efficient products/services will obtain energy savings without continual utility costs purchasing those savings.

MT efforts differ from standard DSM programs in two distinct aspects:

1. Their purpose is in changing the operation of a particular market rather than the acquisition of energy savings more directly. (Energy savings do, however, continue to be an important long-term outcome of the MT process.)
2. MT programs are designed to ensure that long-term impacts continue to occur after the MT intervention has concluded, i.e., permanent market changes.

For evaluation, these differences have consequences as to what needs to be evaluated and the timing of the evaluation/targeted results. More specifically, the difference between the primary objective of MT versus traditional DSM programs translates into a difference in what should be measured as well as the techniques used to perform the analysis. The level of savings achieved through an incentive paid to a participant or Energy Service Company ("ESCo") in a standard DSM program was clearly determined by the aggregate of the electricity savings obtained through program

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1 Goldstone, Seymour. "Restructuring: A Stimulus to Improving Utility DSM, How Economists Might Help", Western Economic Association, CA: San Diego, July 5-9, 1995. Other relevant work includes:
Golove, William and Joseph Eto. *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency*, Earnest Orlando Lawrence Berkeley National Laboratory, Berkeley, California: LBNL-38059, March 1996.
Meyers, Edward, Stephen Hastie, and Grace Hu. "Using Market Transformation to Achieve Energy Efficiency: The Next Steps", *The Electricity Journal*, May 1997, pp. 34-41.

2 Eto, Joe, Ralph Prahl, and Jeff Schlegel. *A Scoping Study on Energy-Efficiency Market Transformation by California DSM Programs*, prepared for the California Demand-Side Measurement Advisory Committee (CADMAC) Project 2091T, Earnest Orlando Lawrence Berkeley National Laboratory, Berkeley, California: LBNL-39058, 1996.

participation. Evaluation, therefore, involved measuring participant energy savings from program activity (i.e., rebates provided or measures installed).

The objectives in a MT program are to remove or reduce specific market barriers, such as performance uncertainties, lack of information, lack of financing, or risk tolerance. Evaluating whether this objective is being met requires pre and post measurement of these barriers.

Reducing the market barriers is then expected to cause an increase in the proportion of customers who decide to acquire the more efficient equipment. The immediate objective and action is the reduction of the barrier, not the final purchasing decision -- which may not occur for years to come. Therefore, the performance metrics or indicators of market effects developed to track program success must be sensitive to the issue that energy savings will not be immediate, but will likely be achieved gradually.

Several researchers in the MT field have noted the need to measure proximate indicators of market changes rather than the final acquisition decision in order to measure MT effects.[3] Measuring the proximate indicators are recommended not just because of the difficulty in measuring the final purchase behavior, but also because changing these market elements is truly the objective for which the MT program is designed. The success of an MT effort should be evaluated in terms of changes in the market elements that have been targeted for change. For example, if a MT program is attempting to increase the proportion of energy-efficient models marketed by vendors, the proportion of vendors' marketing that meets these criteria before (baseline measurement) and after the MT effort could be measured. If the MT effort is trying to change the display design and shelf-space provided for a product, assessing display design and shelf-space before and after the MT effort would be appropriate.

The Boston Gas Company is operating both market transformation programs and DSM programs. In 1998, the Boston Gas Company has had market assessment and baseline studies conducted for their primary market transformation efforts: for the residential gas heating equipment market, the commercial/industrial gas heating equipment market, and the residential new construction market. Also in 1998, an impact and process evaluation was conducted for the Boston Gas Company's Low-Income Energy Savings Program. This paper presents the differences between the measurement issues for the MT effort versus a standard DSM program evaluation using examples from these various measurement efforts in a common framework for comparison.

MT Studies Are Market Focused Rather Than Participant Focused

The focus of a DSM evaluation study is upon the program participants. These are the customers from which the DSM resource is being acquired. This focus leads to examination of the impacts from their participation by examination of changes in the participants' energy usage, and the participant's program satisfaction.

Non-participants may also be examined in DSM evaluation. But as this designation implies, the look at these customers are generally only for the purpose of performing some type of comparison between them and the participants. A study with non-participants is still participant-focused.

On the other hand, a market transformation effort looks to change the way the market operates rather than directly acquiring energy resources from a set of customers (participants). This requires a market focus rather than a participant focus. From this, everyone involved in the market is of interest to market transformation (MT) studies. This includes all customers in the market for the energy equipment or service, not just those that somehow have direct contact with the MT effort. It also

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3 One of the early and most cited works is that of: Feldman, Shel. "How Do We Measure the Invisible Hand?", *Proceedings of the 1995 Energy Program Evaluation Conference*, IL: Chicago, August 1995, pp. 3-8.

includes all entities involved in the market providing supply services anywhere in the supply chain or providing ancillary services.

The type of information desired from a DSM evaluation is also different from that needed in MT studies. The DSM impact evaluation must measure the resources acquired, the purpose of the program, in terms of energy and demand savings. Then a process evaluation may look at how the program operates, whether the customers are satisfied, and how the program may be improved in order to more effectively attract participants and acquire additional energy and demand savings from them. The MT effort works at reducing market barriers to allow the market to operate so adoption of energy efficient options occurs at the level it is cost-effective. MT measurement, therefore, must focus on market operation and the reduction of market barriers. The essence of the difference lies in the fact that DSM evaluation is participant-focused while MT measurement is market focused.

Table 1 outlines the studies conducted in the DSM evaluation of Boston Gas' Low-Income Energy Savings Program, the types of information gathered in the DSM evaluation, and from whom the information was obtained. This can be compared to Table 2 which provides similar information for the market assessment and baseline study on the residential gas heating equipment market for Boston Gas' MT effort in that market. The readily apparent difference in these two tables is that the MT studies have a much broader scope and greater number of market participants to examine than the DSM evaluation.

Table 1. Who and What Information is Desired in DSM Evaluation
(e.g. Boston Gas' Low-Income Energy Savings Program Evaluation)

Type of Study	Information Gathered	From whom?
Impact evaluation	Energy and demand savings	Participants (bills)
Process evaluation	Customer satisfaction with program and its components	Participants
	How did participants learn of program and why they participated?	Participants
	Impacts seen by participants	Participants
	What worked well in the program and what improvements might be made?	Participants Utility supervisory staff External agencies Program administrator Program implementers
	How well does the tracking system work and how might it be improved?	Tracking system Utility supervisory staff Program administrator Program implementers

Table 2. Who and What Information is Desired in MT Studies
(e.g. Boston Gas' Market Assessment and Baseline Study
for the Residential Gas Heating Equipment Market)

Type of Study	Information Desired	From whom?
Market Characterization	Who are the players?	Customers in the residential gas heating equipment (r. gas htg) market Contractors and plumbers who sell or install r. gas htg Distributors who sell r. gas htg
	How do the players interact? What are the communication links?	Customers in the residential gas heating equipment (r. gas htg) market Contractors and plumbers who sell or install r. gas htg Distributors who sell r. gas htg
	Where and what are the market barriers for high efficiency adoption?	As above.
Baseline Assessment (& later Market Progress Measurement)	Awareness of high efficiency (HE) r. gas htg	As above.
	Knowledge among recent market participants	Customers in the residential gas heating equipment (r. gas htg) market
	Quality of HE installations	Expert verification
	Product availability	Customers in the residential gas heating equipment (r. gas htg) market Contractors and plumbers who sell or install r. gas htg Distributors who sell r. gas htg

Table 2. Who and What Information is Desired in MT Studies (Continued)

	Frequency, amount of advertising	Contractors and plumbers who sell or install r. gas htg Distributors who sell r. gas htg Objective measurement
	Penetration	Estimate of proportion of market HE
	Perception of performance & reliability	Customers in the residential gas heating equipment (r. gas htg) market Contractors and plumbers who sell or install r. gas htg Distributors who sell r. gas htg
	Prices, competitiveness	As above.

Market Focus Creates Different Research and Sampling Design Needs

The different questions and numerous market participant information sources in the MT studies create the need for more research instruments and more complex sampling than is generally required in DSM evaluations. Table 3 summarizes the research and sampling designs for Boston Gas' low-income DSM program evaluation and residential gas heating equipment market studies.

One of the greatest difficulties for MT studies is in obtaining information from recent market participants among consumers. DSM evaluations know their survey population, the list of program participants. There is not, however, a list of those thinking about a specific energy equipment purchase and of all recent purchasers. This generally means that MT studies must ask screening questions of a general population of consumers to identify the target customers, a significant added complexity to sampling that DSM evaluations have not had to address.

This screening for Boston Gas' residential heating equipment studies involved asking a random sample of residential gas heating customers whether they had recently been in the market for heating equipment (thinking about purchasing or having purchased new gas heating equipment in the last two years). The target sample was expected to be at least 12% of the full random sample. This low incidence rate meant that a large number of surveys were needed to reach the desired number of 400 target customers. With a 25% expected return rate, the required mail-out size for the survey was 15,400.

Both DSM evaluations and MT studies use interviews. DSM process evaluations often conduct interviews to obtain a variety of perspectives concerning program operation and potential improvements from the individuals involved in program planning, evaluation, and implementation. MT studies conduct interviews of the various market actors to determine market structure, operation, market barriers, and examine what might make energy efficiency a more dominate force in the market.

Besides the differences in information sought, the differences in the type of individuals interviewed for DSM evaluations as compared to MT studies creates a few more difficulties for MT studies.

Table 3. Research and Sampling Comparison

Research instrument	DSM Evaluation	Market Transformation Studies
Billing Analysis	articipant bills from one year prior o participation to one year post articipation (ANCOVA regression nalysis).	one
Survey - Type	elephone survey	ail survey
Research group	articipants	arget = recent market participants mong complete market
Sample	00 randomly selected	ailed to random sample of esidential gas heating customers: 5,400 esponded: 2,530 ubset of market participants: 459
Interviews	5 minute process evaluation nterview	hour market in-depth interview
Research group	0 Total: tility supervisory staff – 2 xternal agencies – 3 ommunity Action Agencies implementers) – 3 nstalling contractors – 2	6 Total: ontractors – 19 lumbers – 21 istributors – 6
Sample	ists from program manager	andom sample from ommercially available lists of hese actors in area market. uring sampling process, obtained otal numbers of each market actor n this market.
dvertising Content nalysis	one	ajor and local newspapers, and ndustry publications of the elevant market actors.
ite Visits	one	igh efficiency installation sites rom volunteers from survey articipants and program articipants.

Program staff and program implementers can recognize the need for the DSM evaluation and are quite likely to be relatively cooperative in scheduling an interview. Interviewing market actors (contractors, plumbers, and distributors) in a competitive market can be much more difficult. These participants in a competitive market are often leery of providing any information they may have on the market for fear of hurting their competitive position. They also see no benefit to them of taking time

away from their market activities to participate in such an interview. Financial remuneration is often required as a minimum to obtain these interviews, as well as a carefully worded introduction and diligence.

The cost of in-depth interviews often make them expensive, leading to having few conducted. Generally, there is a small finite list of individuals from which process evaluation interviews are conducted. This means that the group can easily be well represented by conducting from only five to a dozen interviews. In MT studies, there are often more groups of market actors and it can be more difficult to define the actual population of each group. The smaller proportion of the population being interviewed along with the small numbers of interviews for any group can make interpretation of results less clear for MT studies than for DSM process evaluations.

"Big Picture" Analysis for MT Compared to Detailed DSM Savings Analysis

The analysis perspective for MT studies versus DSM studies are somewhat opposite one another. Generally, the DSM evaluation "drills down" with each step and question asked during its analysis phase. Contrary to this, MT studies require a constant look at what is being seen in other areas of the market and how that interacts with other market participants' actions – often a "big picture" perspective.

For example, in DSM evaluation there is an estimate made of the energy savings or an examination of whether the customer is satisfied. A more detailed exam may be made to learn the components of energy savings, demand savings, or net savings. Similarly, customer satisfaction is dissected according to various program elements and how these match areas of possible program improvement gleaned from the interviews. Each of these analysis processes involves looking at an outcome and issue in more and more detail in order to discern cause and what actions might be considered.

A MT study will examine the market barriers in each category for each market participant. But then it needs to assess where the barriers are the largest and how these interact throughout the market. Often, a clear picture of needed action is not completely discerned in a MT study unless all the pieces are looked at together. For example, in the Boston Gas MT study the distributors all claimed that high efficiency residential gas heating equipment was as reliable as standard efficiency equipment. A significant proportion of the contractors and plumbers, nonetheless, stated that this equipment was not as reliable as the standard equipment. At first these two sets of findings seemed irreconcilable. A further examination of the distributor interviews, nevertheless, found that there were distributors that stated that there was a severe shortage of contractors and plumbers qualified to perform repair services for the high efficiency equipment. This was confirmed by two contractors and plumbers that said that they received a lot of business because they were one of the few that knew how to perform adjustment and repair services for the high efficiency equipment. A hypothesized conclusion offering consistency between the reports from contractors, plumbers, and distributors is that high efficiency equipment might be physically as reliable as the standard but that when there are problems there is not a repair sub-market available making any problems appear much greater.

Guidelines for MT Measurement from CADMAC Summary Study

In 1997 and 1998 the California Demand-Side Measurement Advisory Committee (CADMAC) commissioned 15 studies to assess the market effects achieved by DSM programs in the prior years. A study summarizing and reviewing these 15 studies as a guiding document for future MT measurement

efforts in California was recently complete: *Market Effects Summary Study, Final Report, Volumes 1-3*, by Research Into Action, Inc., Pacific Consulting Services, and Megdal & Associates for the California Demand-Side Measurement Advisory Committee (CADMAC), December, 1998. This study included insights into MT evaluation and recommendations for changes in the MT evaluation efforts for future California studies.

The following initial list of guidelines for MT measurement was gleaned from the recommendations and insights from the *Summary Study*[4].

Market transformation evaluation should include the following:

- Data collection procedures and design should be grounded in a comprehensive understanding of the market: Define market barriers from a characterization of the market, and then collect data to measure these barriers and test whether they remain after intervention.
- Program designers and evaluators should use a two-tier approach: 1. Market characterization. 2. Market effects measurement.
- Evaluations of MT programs can use data collection methods similar to those used in process and market evaluations of DSM programs, BUT they must be market-focused, not participant-focused.
- Analysis methods and scope of data collection efforts may derive more broadly from marketing, social science, and economics than occurred with prior DSM evaluation.
- Distinguish between market changes observed independent of the program and market effects attributed whole or in part to the program.
- A reliance on qualitative data for determination of program attribution may be more prevalent with MT efforts than with prior DSM evaluation.
- Criteria need to be set for sustainability relating to the specific MT goals and objectives. Some of the likely conditions for sustainable market effects are:
  - New market entrants
  - Valuing of non-energy benefits
  - Position and momentum in the diffusion process
  - Institutional adoption
  - Market structure changes that eliminates barriers
  - The development of profitable private market entities to facilitate continued market transformation.

Conclusion

The basic research techniques used in DSM evaluations are used in MT studies: surveys, and interviews. But the focus of what to ask and who to ask is quite different. Knowing these differences and their consequences for the research and sampling design can help the evaluator learn from their prior DSM evaluation work and more easily transition to conducting market transformation studies.

The primary differences are summarized as follows:

1. DSM evaluation seeks to answer the amount of energy and demand savings acquired and how this might be improved while MT studies ask questions concerning market operation,

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4 *Market Effects Summary Study, Final Report, Volumes 1-3*, by Research Into Action, Inc., Pacific Consulting Services, and Megdal & Associates for the California Demand-Side Measurement Advisory Committee (CADMAC), December, 1998, pp. ES-VIII through ES-XI.

market barriers, communication flows and diffusion for adoption for energy efficiency equipment and practices;

2. DSM evaluation seeks these answers from participant information and those involved with the program while MT studies must go to all the various market participants;
3. Going to all the various market participants can make sampling design more complex for MT studies than for DSM evaluation;
4. Obtaining information on a large variety of market participants with different types of market functions and potential market barriers can create a more complex research design for MT studies than was seen with DSM evaluations; and
5. The analysis perspective for DSM evaluation was often a "drill down" approach, seeking more detail to answer subsetting questions or why particular overall results were obtained. On the other hand, MT studies often must continually review analysis against that seen with other market barriers or other market participants – getting the "big picture" – in order to understand the results and the actions that might address the actual barriers seen in the market.

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