



A Review of Effective Practices for the Planning, Design, Implementation, and Evaluation of Market Transformation Efforts

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Executive Summary

This study identifies effective program planning, design, implementation, and evaluation practices as described in the market transformation (MT) literature. It also examines practices that have been used to support MT for five types of residential programs (lighting, products including appliances and consumer electronics, whole house, HVAC, and new construction) in jurisdictions outside California. The purpose of the study was to identify and summarize effective practices in support of MT from both programs and the literature for the consideration of the California investor-owned utilities (IOUs).¹

Approach

To meet the study objectives, NMR reviewed key reports and conference papers on the planning, design, implementation, and evaluation of MT programs to develop a summary of practices recommended in the literature. NMR also identified residential programs in the Pacific Northwest, New England, and New York that qualify as “strategic market transformation” programs as described by Prahl and Keating:

*Strategic market transformation is a program approach that uses ‘the tools of market transformation to make a deliberate and rigorous effort to intervene in [targeted], clearly defined markets.’ Strategic MT programs are expected to have market-transforming effects. Strategic MT acknowledges that not all markets are transformable, and allows for the tactical incorporation of other programs in the effort to change the target market.*²

For these programs, NMR obtained and reviewed program reports to glean information on the program designs, strategies, evaluation approaches, and other relevant topics. Finally, the research team interviewed staff representing eight programs across four administrators of strategic market transformation programs—Efficiency Vermont, the Massachusetts Program Administrators (Berkshire Gas, Columbia Gas, National Grid, New England Gas, NSTAR/Western Massachusetts Electric, and Cape Light Compact), the New York Energy Research and Development Authority (NYSERDA), and the Northwest Energy Efficiency Alliance (NEEA)—to further understand the actual planning, design, implementation, and evaluation practices for these programs.

Summary of Effective Practices

Through the literature review, NMR identified the following effective planning, design, implementation, and evaluation practices in support of MT program approaches.

Effective program planning, design, and implementation include the following practices:

1. Identify target markets

¹ Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and Southern California Gas.

² Prahl, R., & K. Keating, “Planning and Evaluating Market Transformation: What the Industry has Learned, and Possible Implications for California” (Market Transformation Workshop, Consultant Whitepaper Draft, October 17, 2011).

2. Characterize the market
3. Identify the baseline and ensure ample savings are possible
4. Develop a market model
5. Develop program theory and logic model and match program theory to market characterization
6. Develop a market transformation story
7. Establish interim and long-term indicators of market effects
8. Articulate an exit or transition strategy for when transformation is complete
9. Continue to measure and monitor key market indicators after transition
10. Work with markets by doing the following:
 - Recognize and use market forces
 - Find market allies who are willing to work with the program
 - Promote competition
 - Share risks with other market actors
 - Use upstream market actors to influence downstream adoption of energy-efficient products and services
11. Identify and promote non-energy benefits to the product or service
12. Leverage resource acquisition tools or programs
13. Take the innovation adoption curve into account:
 - Focus on early adopters in opening markets for innovative products, including energy-efficient products
 - Avoid the “chasm” between adoptions by innovators and the general public
14. Form a market-based advisory group to help shape and review the program

Effective program evaluation includes the following practices:

1. Match the evaluation strategy to the program logic
2. Track indicators tied to expected outcomes
3. Perform regular, ongoing research into the status of the market
4. Assess market effects periodically
5. Refine the program theory and logic model
6. Assess attribution
7. Calculate net savings at the market level
8. Assess sustainability and prepare for exit or transition
9. Tell the market transformation story
10. Continue tracking market effects after the program has ended

Implementation of Practices

The interviews and review of program reports suggest that the program administrators with programs examined for this study undertake most of the planning, design, implementation, and evaluation practices listed above. There are a few exceptions, mostly practices that we were not able to examine for the study or practices carried out by NEEA alone.

We found that one practice—developing a graphic market model (3.1.4)—is not routinely carried out by any of the program administrators. In addition, only NEEA carries out four of the practices associated with planning for market exit or transition and tracking market effects after the program has ended.

In regard to claiming savings from market effects, the Massachusetts Program Administrators and NYSERDA are able to claim these savings to the extent that they are embedded in net-to-gross (NTG) ratios. NEEA funders are able to claim the energy savings from the net market effects of NEEA initiatives.

We found no MT-specific evaluation protocols in use by any of the program administrators, although NYSERDA operates under evaluation guidelines that provide general guidance on spillover attribution measurement and is developing market effects measurement guidelines, while Massachusetts Program Administrators operate under standardized approaches to estimating program-level net savings. However, these guidelines and standards are not prescriptive.

While the study did not focus on policy, it yielded the following policy-related insights from the interviews:

- Claiming savings from programs' market effects may be simpler in states or regions with a clear, consistent market transformation program track and framework, especially the Pacific Northwest.
- Less prescriptive evaluation protocols may be preferable for MT, as these approaches allow methods to change as programs and markets change.
- If programs focused on transforming markets are to be treated like generation or resource acquisition savings, the relatively long wait before MT efforts bear returns must be taken into account in both planning and evaluation.
- While the calculation of NTG based on a program's effects within a single year is an example of an evaluation timeframe that is too short to take market effects from MT into account, the near-annual measurement of NTG for residential lighting in Massachusetts has accounted for the acceleration of the adoption curve, thereby demonstrating the market effects of the Massachusetts program and partially overcoming the limitations imposed by the regulatory requirement of examining net savings within the program year only.
- For cases in which program administrators report to regulators, an informal, collaborative approach to evaluation planning may benefit MT efforts. Several interviewees offered some important related insights, including the following:
 - MT evaluation can be improved by involving program staff members in evaluation planning and obtaining their input in developing measurement instruments such as survey questions and data collection forms.
 - It is wise to plan for evaluation while planning the program in order to make sure to collect the data that will be needed for evaluation from program inception.

- Program administrators should work together to try to negotiate getting sales and other data as part of contracts with program partners.
- Placing responsibility for market research with an organization other than the program administrator may impede carrying out timely market characterization studies that provide rich information about the dynamics of a particular market.
- It is difficult to operate programs with MT goals while simultaneously attempting to meet ambitious resource acquisition goals, although resource acquisition programs can be leveraged as part of a greater MT effort.

Supporting Appendices

The study includes appendices with detailed information about barriers commonly identified for the program types, strategies of each individual program and the market actors targeted, the types of market progress indicators tracked, and program descriptions and logic models.

1 Introduction

1.1 Objectives of the Research

The objective of this study is to identify effective program and evaluation practices that have been used to support market transformation (MT) for five types of residential programs in jurisdictions outside California and to summarize these practices for the consideration of the California investor-owned utilities (IOUs).³ The study focuses on actionable lessons learned from the experiences of program administrators who have long implemented MT program approaches for the program areas of lighting; products (appliances and consumer electronics); whole house; heating, ventilation, and air conditioning (HVAC); and new construction.

To meet this objective, the research team reviewed key reports and conference papers on the planning, design, implementation, and evaluation of MT programs to develop a summary of practices recommended in the literature. The team also identified residential programs in the Pacific Northwest, New England, and New York that qualify as “strategic market transformation” programs as described by Prahl and Keating,⁴ and obtained and reviewed reports about these programs to glean information on the program designs, strategies, evaluation approaches, and other relevant topics. Finally, the research team interviewed staff members representing eight programs across four program administrators in order to understand the actual planning, design, implementation, and evaluation practices of these program administrators in greater depth. The study focuses on identifying lessons learned that the IOUs may wish to put into action for themselves. To this end, the study includes appendices with the following detailed information: 1) barriers commonly identified for the program types, 2) strategies of each individual program and the market actors targeted, 3) the types of market progress indicators tracked, and 4) program descriptions and logic models.

1.2 What is Strategic Market Transformation?

Many energy-efficiency programs—both those designed primarily for market transformation and those intended mainly for resource acquisition—can lead to market effects. In some cases, programs or sets of programs can even bring about market transformation without strategically setting out to do so. *Strategic* market transformation, however, results from a subset of market transformation programs and activities explicitly designed and implemented to bring about market transformation.⁵

The current definition of *market transformation* for the State of California is:

³ Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and Southern California Gas.

⁴ Prahl and Keating, “Planning and Evaluating Market Transformation.”

⁵ Ibid.

. . . long-lasting, sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where continuation of the same publicly funded intervention is no longer appropriate in that specific market. Market transformation includes promoting one set of efficient technologies, processes or building design approaches until they are adopted into codes and standards (or otherwise substantially adopted by the market), while also moving forward to bring the next generation of even more efficient technologies, processes or design solutions to the market.⁶

Prahl and Keating define *strategic market transformation* as a subset of market transformation. For the purposes of this study, the research team has condensed their insights into the following definition:

Strategic market transformation is a program approach that uses ‘the tools of market transformation to make a deliberate and rigorous effort to intervene in [targeted], clearly defined markets.’ Strategic MT programs are expected to have market-transforming effects. Strategic MT acknowledges that not all markets are transformable, and allows for the tactical incorporation of other programs in the effort to change the target market.

According to Prahl and Keating,

Strategic MT requires that:

- The market be defined clearly enough to be targeted;
- The market be characterized so that program administrators can understand the opportunities and barriers as well as the relationships in the market;
- A baseline for the targeted measure or practice be identified, and be trackable over time;
- The market/product nexus will produce large enough savings if successful to justify the resources;
- There is a coherent market and program theory usually captured in a logic model, that connects the expected actions with the desired outcomes; and,
- [Program planners determine] whether there is a better approach to capturing the potential energy savings such as an acquisition program.⁷

Guided by this definition, our review identifies appropriate practices in support of strategic MT and program efforts that best reflect the ideal of strategic MT among the geographic areas included in the study.

⁶ California Public Utilities Commission, “Decision Approving 2010 to 2012 Energy Efficiency Portfolios and Budgets” (Decision 09-09-047, September 24, 2009), <http://www.cpuc.ca.gov/NR/rdonlyres/A08D84B0-ECE4-463E-85F5-8C9E289340A7/0/D0909047.pdf>, 89.

⁷ Prahl and Keating, “Planning and Evaluating Market Transformation,” 6.

2 Research Methodology

To accomplish the objectives of this paper, NMR conducted a literature review to identify effective approaches to planning, implementing, and evaluating MT programs. In doing so, we identified a selection of programs that fit the profile of “strategic MT,” reviewed publicly available evaluation reports about these programs, and conducted in-depth interviews with staff members and other representatives of a subset of these programs. A detailed description of how we carried out these tasks is below. The research was performed from July through September of 2013.

2.1 Literature Review

The purpose of this literature review is to identify important elements of strategic MT, especially approaches to the planning, design, implementation, and evaluation of MT interventions that the literature suggests are effective. The literature included in the review is partially a convenience sample comprising white papers and conference presentations known to the project team. We also identified and reviewed relevant ACEEE Summer Study and IEPEC papers. In total, we reviewed 32 documents for this portion of the research. These are listed in Section 7.2.

2.2 Identification of Strategic MT Programs and Review of Program Documents

To identify potential strategic MT programs that represented the five residential program types examined in this study (lighting, products [i.e., appliances and consumer electronics], whole house, HVAC, and new construction), NMR developed a snowball sample through speaking with knowledgeable industry contacts about relevant programs in the Pacific Northwest, New England, and New York. We based this selection of regions and states on the work of Prahl and Keating⁸ and Rosenberg and Hoefgen,⁹ as well as the NMR team’s extensive prior experience with MT program evaluation.

To help in the selection of programs, we searched for evaluation reports and plans for these programs on websites of energy-efficiency program administrators, public service commissions, the Consortium for Energy Efficiency (CEE), and the Northwest Energy Efficiency Partnerships (NEEP), and in some cases from program administrator staff. NMR reviewed these documents to evaluate the extent to which each program identified appeared to qualify as a strategic MT program. In this way, we identified 14 programs that fit the working definition of strategic MT. These programs are run by four program administrators or teams of administrators: Efficiency Vermont, the Massachusetts Program Administrators (Berkshire Gas, Columbia Gas, National

⁸ Prahl and Keating, “Planning and Evaluating Market Transformation.”

⁹ Rosenberg, M., and L. Hoefgen, “Market Effects and Market Transformation: Their Role in Energy Efficiency Program Design and Evaluation,” California Institute for Energy and Environment, 2009, accessed July 10, 2013, http://www.calmac.org/publications/Market_Effects_and_Market_Transformation_White_Paper.pdf.

Grid, New England Gas, NSTAR/Western Massachusetts Electric, and Cape Light Compact), the New York Energy Research and Development Authority (NYSERDA), and the Northwest Energy Efficiency Alliance (NEEA).

For two reasons, this set of programs is not a comprehensive listing of strategic MT programs of these types in the regions examined. First, due to budget limitations, we were not able to conduct a truly exhaustive search for programs that fit the definition. Second, we were unable to obtain program documents for some programs that we believe fit the definition, and thus we could not include them in the study.

After determining which programs to include in the study, NMR conducted a more in-depth review of the program documents to answer these and other questions described in this report:

- Were the program domain and target market identified?
- What strategies were used?
- Is there a graphic market model?
- Is the program theory articulated? Is there a logic model? If so, are they linked to the market model?
- What, if any, market progress indicators were tracked for the program?
- Was attribution assessed, and if so, how?
- How frequently was market research conducted?

NMR also kept an eye out for any information in the program documents that could shed light on the approaches taken to planning, designing, or implementing the programs. Table 2-1 below shows the number of program documents we reviewed in this way.

Table 2-1: Summary of Program Documents Reviewed

Program Area	Number of Documents Reviewed	Notes
Lighting	15	Six of these were also reviewed for Products; two were reviewed for New Construction
Products	19	
Whole House	7	Six of these were also reviewed for Lighting
New Construction	14	Two of these were also reviewed for Lighting
HVAC	3	
TOTAL	58	

2.3 In-Depth Interviews

NMR selected eight programs from across the five residential program areas and the four program administrators for more thorough investigation via in-depth interviews with program staffs. The purpose of the interviews was to gain a more detailed understanding of the approaches taken by these program administrators to the planning, implementation, and

evaluation of these strategic residential MT programs. The following programs were selected to represent the range of residential program areas and administrators:

- Efficiency Vermont's Home Performance Program and Residential New Construction Program
- The Massachusetts Program Administrators' ENERGY STAR Lighting Program
- NYSERDA's New York Home Performance with ENERGY STAR Program and New York ENERGY STAR Certified Homes (NYESCH) Program
- NEEA's Consumer Electronics TV Initiative, ENERGY STAR Clothes Washers Initiative, and Ductless Heat Pump (DHP) Initiative

3 Summary of Effective Planning, Design, Implementation, and Evaluation Practices for Strategic MT

This chapter summarizes the most important elements of strategic market transformation as identified in some of the essential literature on the topic, including Sebold et al.,¹⁰ Prah and Keating,¹¹ Keating,¹² and Rosenberg and Hoefgen.¹³ First, we discuss effective program planning, design, and implementation practices, and then effective evaluation practices. It is important to note that, while the topics are separated for ease of presentation, they are (or should be) deeply intertwined in practice.

3.1 Program Planning, Design, and Implementation Practices

All energy-efficiency programs require careful planning, but the nature of strategic market transformation necessitates that program administrators take additional care in the planning process that may not always be required in resource acquisition efforts. Program administrators contemplating strategic market transformation should consider the following:

- Only some products and services are strong candidates for strategic market transformation efforts.
- Transformation of large and established markets necessitates considerable commitments of time and money.
- Successful evaluation of strategic market transformation efforts begins during the program planning stage with careful identification of market indicators, baseline measurement of these indicators, and provision for their ongoing measurement.

This section describes the practices identified in a review of the literature on market transformation that appear to be key to the successful design, planning, and implementation of such programs. The first set of practices in this section is organized into numbered steps for ease of understanding and to provide readers with a general sense of the order in which the literature indicates they are to be undertaken. The order of practices that is most appropriate for a program administrator or situation may vary somewhat depending on factors such as the market in question, the program and research budget, and the size and relative importance of the savings opportunity. The second set of practices in this section is organized by general topic.

¹⁰ Sebold, F. D., Fields, A., Skumatz, L., Feldman, S., Goldberg, M., Keating, K., and J. Peters, "A Framework for Planning and Assessing Publicly Funded Energy Efficiency," Study PG&E-SW040, 2001, accessed July 9, 2013, <http://library.ceel.org/sites/default/files/library/1235/412.pdf>.

¹¹ Prah and Keating, "Planning and Evaluating Market Transformation."

¹² Keating, K, "Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives," draft, March 18, 2013.

¹³ Rosenberg and Hoefgen, "Market Effects and Market Transformation."

3.1.1 Step 1: Identify Target Markets

Prior to planning a market transformation program, planners must first identify the markets and products that are amenable to transformation. It is important that the market be defined clearly enough to be targeted.

During the course of program planning, it is imperative to verify that a transformation strategy makes the most sense for a particular market. Five conditions stand out as the most critical. Keating has noted the first four, and NMR adds a fifth.

First, planners must consider the size of the market. As Keating explains, the market must be large enough “to justify the resources and the long term commitment required to create the desired change.”¹⁴ For example, the market for small fans probably does not present enough savings opportunities to justify a market transformation effort, in contrast to the market for air conditioning, which accounts for a large proportion of energy use; the efficiency of the fan market might be better addressed through a program targeting motors.

Second, market transformation programs work best when the product or service comes with considerable non-energy benefits. Many consumers may not be willing to pay more for an energy-efficient product or service unless it offers additional benefits not regularly associated with less efficient options. However, if the product or service also offers other perks, consumers may be willing to pay extra for energy efficiency. ENERGY STAR-qualified clothes washers are a quintessential example. These washers save substantial energy savings but they also lower water bills, reduce drying times, and are gentler on clothes; many models come with advanced controls and settings.

The third and fourth conditions often go hand-in-hand. The third is that products yielding small savings per transaction but large savings in the aggregate represent strong candidates for an MT initiative, while the fourth is that the savings can be expected to be cost-effective in the long term. Small savings per transaction can challenge cost-effectiveness tests, particularly if the measure is somewhat costly in relation to the achieved per-unit savings. In such situations, focusing on upstream and midstream interventions (e.g., incentives, training, advertising, research and development, etc.) may provide a model that meets cost-effectiveness tests, particularly in the long term, while still saving substantial amounts of energy in the aggregate and moving markets toward transformation. CFLs are a good example of a measure with small savings per transaction but large savings in the aggregate. New homes do not fit this paradigm—they save substantial amounts of energy over the typical newly constructed home while still representing what is often the largest purchases most home buyers will ever make—but progress toward transforming the new home market in New York, Vermont, and elsewhere shows that the third condition may not be essential if the fourth (long-term cost-effectiveness) is met.

A fifth condition relates less to the market and more to the regulatory and political environment in which the program operates: Market transformation efforts are most effective when the

¹⁴ Keating, “Guidance on Designing and Implementing,” 3.

regulatory framework supports them. As mentioned above and discussed more below, market transformation requires considerable up-front resources. Some program administrators may find that the regulators and legislators who oversee their efforts are not willing to invest substantial amounts of money now for savings that may be achieved at some point in the future, particularly if immediate estimates of key indicators (e.g., market share, cost-effectiveness, net savings) point to minimal progress toward transformation. While careful explanations of the theories behind market transformation and recounting of some major success stories (e.g., resource-efficient clothes washers and, more recently, CFLs) have persuaded regulators in many jurisdictions to give MT a try, recent movement back toward resource acquisition strategies in some jurisdictions (e.g., MA for residential lighting, apart from its market lift initiative) highlights the challenges MT efforts can face when regulators must justify efforts to ratepayers and politicians who may not share program administrators' long-term perspective on market transformation.

Program planners also need to make certain that the target market exhibits “significant market failures.”¹⁵ Market failure occurs when “the interaction of demand and supply does not result in the socially optimal quantity of the good or service being consumed and produced,” argue Sebold and his colleagues.¹⁶ They cite four fundamental reasons that markets fail:

1. The price does not reflect external costs.
2. Market actors have imperfect information about the product, which often reflects the newness of a technology.
3. The product is a public good.
4. The market suffers from imperfect competition (e.g., few firms in the market, hard to enter or exit the industry, heterogeneous goods or services).

If the market does not exhibit one or more of these fundamental failures, then it most likely is not a strong candidate for a transformation effort. Assessing such failures and other characteristics that would make a market a good target for a market transformation approach is part of a good market characterization study.

¹⁵ Sebold et al., “A Framework.”

¹⁶ Ibid., 2-6 (citing Stiglitz 1993).

3.1.2 Step 2: Characterize the Market

Program planners must make certain that they have allocated ample time and funds during the planning process to carry out a good market characterization study. Rosenberg and Hoefgen¹⁷ state that MT strategies are built on assumptions about the way market actors will respond to program offerings over time. Keating echoes this statement and stresses the importance of understanding the market actors, noting that “a market characterization is more than a simple description of the market. It also involves knowledge of who influences who, how profits are made, where added value occurs, how pricing is done, and where the barriers and potential leverage points might be. This often involves looking at the market from the perspectives of those who are making a living in it.”¹⁸

Carrying out a strong market characterization study early in the program planning process facilitates an accurate understanding of the market and market actors, increasing the likelihood that the program strategies will lead to desired market responses. Conversely, without a good characterization of the market, program administrators could design an effort that does not reflect the actual market conditions or behavior of market actors, leading the program to adopt activities based on faulty assumptions about how the market operates. The characterization may also reveal that a resource acquisition approach may provide a better fit for the market than a transformation approach. Based on market research, typical elements of good market characterization studies include consideration of the following:¹⁹

- Market size
- Technology performance
- Supply-side structure and operation, including key groups of actors, how decisions are made, where value is added, and how prices are set
- Current supply channels for specific products
- Consumer behavior
- Perceptions of market actors of product advantages and barriers to adoption
- Customer segmentation
- Incremental cost of the efficient product or service over standard ones

3.1.3 Step 3: Identify the Baseline

As part of the market characterization, program planners must identify the baseline²⁰ compared to which market effects will be assessed. The initial baseline describes pre-program conditions. It may also include a forecast of how the indicator would be expected to change over time without

¹⁷ Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

¹⁸ Keating, “Guidance on Designing and Implementing,” 5.

¹⁹ Based on Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

²⁰ As Rosenberg and Hoefgen note, “The term ‘baseline’ as it is generally used in energy efficiency program planning and evaluation denotes both the level of the selected indicator at the time a program is evaluated and the trend that indicator would take over time in the absence of program interventions” (Ibid., 62). The latter could also be called a “moving baseline” or “dynamic baseline.”

market intervention. After the program begins operating and affecting the market, the baseline becomes naturally occurring market adoption or the counterfactual—what would have happened in the absence of the program.

Although the market indicators will vary depending on the nature of the market and the product or service, the primary categories include market share for energy-efficient products and services, the saturation of energy-efficient products, price of the product or service compared to less efficient alternatives, availability of efficient products and efficiency services, levels of product or service awareness and knowledge among market actors,²¹ and net energy and demand savings—an ultimate indicator.

As discussed more in Section 3.2, establishing the initial baseline prior to program launch or very early in the implementation phase increases the likelihood that later evaluation activities will provide an accurate estimation of market effects, because any confounding effects of the program on the market have not yet occurred and will be easier to identify when and if they occur.

3.1.3.1 **Related Practice: Ensure Ample Savings Possible**

The potential savings need to be large enough to justify the use of program resources, as market transformation efforts require substantial monetary and other resources to implement. The market characterization and baseline estimation activities should provide planners with the information they need to estimate potential savings and the range of likely costs required to achieve them.

²¹ Although most of the program materials we reviewed include “awareness” among their market indicators, Keating (2013) does not. He argues, “While most market transformation initiatives . . . increase awareness, awareness itself is a very short term measure and is not strongly related to action. Positive perceptions are much more important than awareness, in and of itself.”

3.1.4 Step 4: Develop a Market Model

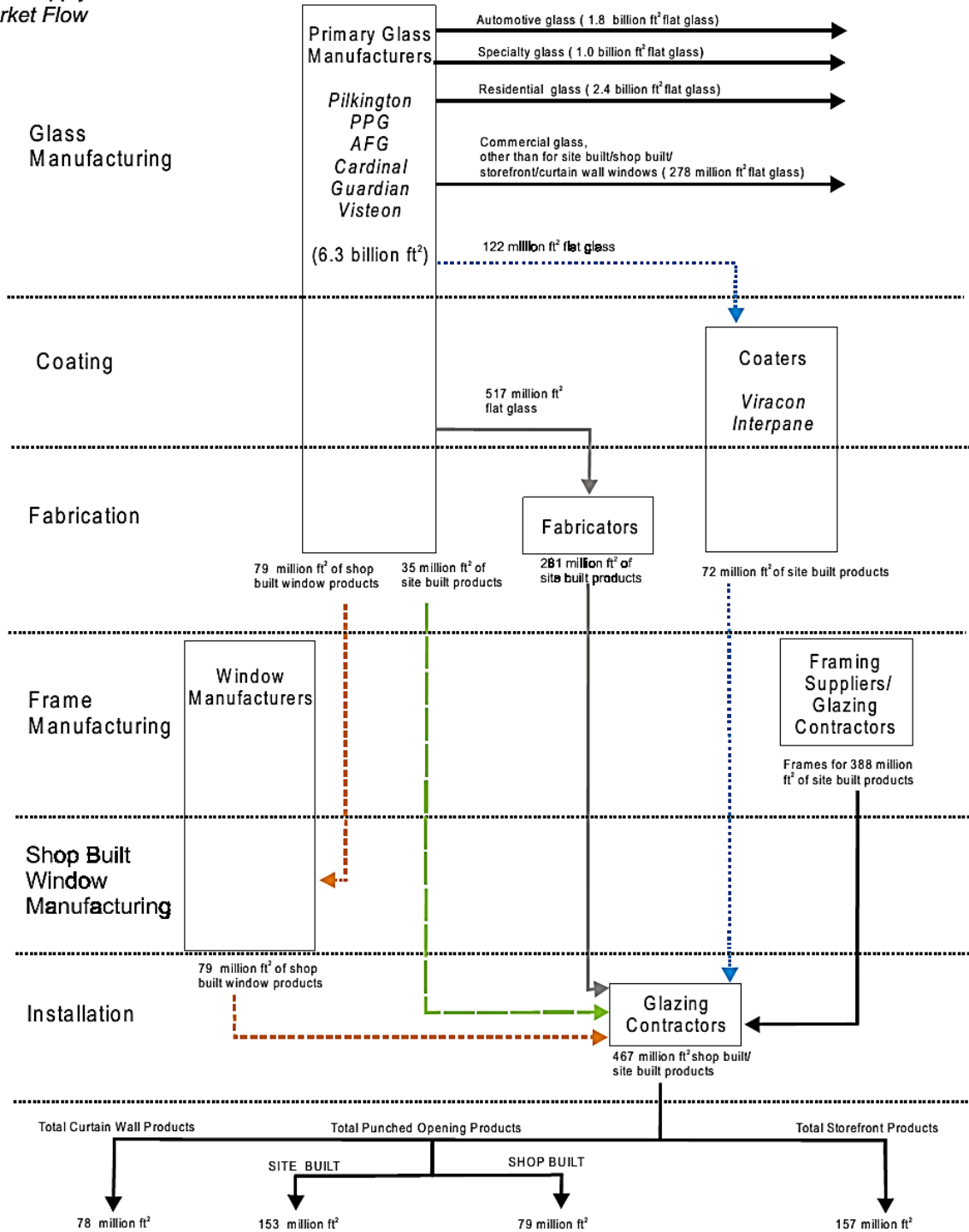
A thorough market characterization helps the practitioner understand how the market works, while going further by developing a graphic market model helps identify gaps and ensures that the practitioner has a good grasp of the structure and functioning of the market. It also helps him or her better envision the linkages and leverage points between the market and what is to become the program. Figure 3-1 below is a partial example of a market model from the Northwest Energy Efficiency Alliance.^{22,23}

²² Eley Associates, "A Characterization of the Nonresidential Fenestration Market," prepared for Lawrence Berkeley National Laboratory and Northwest Energy Efficiency Alliance, report #02-106, November 2002. <http://neea.org/docs/reports/ACharacterizationoftheNonresidentialFenestrationMarket245BC65C935A.pdf?sfvrsn=8>

²³ Although a strong example of a market model, we find it important to note that NEEA cancelled this MT initiative when it became clear that the non-residential fenestration market was too difficult to organize in support of change.

Figure 3-1: Supply-Side Flow of the Fenestration Market

Figure 1 – Supply-Side Market Flow



NOTE: The term "flat glass" refers to single panes of glass.
The term "products" refers to final glazing products.

3.1.5 Step 5: Develop Program Theory and Logic Model

The literature on planning market transformation programs unequivocally advocates for the development of a coherent program theory that describes a causal relationship between the expected actions and the desired outcomes; this program theory or model should be clearly linked to the market model. As Sebold et al. explain, “Articulating the program logic ensures that the activities, resource investments, and evaluation efforts fit with and focus on the core assumptions and causal hypotheses of the planners and policymakers.”²⁴ They also assert that the complexities of the market and of market transformation efforts make market transformation programs “more vulnerable than resource acquisition programs to the misapplication of public resources through faulty understanding of intended outcomes and the causal hypotheses that underlie the selected interventions.”²⁵

Sebold et al. identify six crucial actions required to develop a coherent program theory:

1. Describe the market
2. Lay out the rationale for the intervention
3. Lay out the expected effects of the intervention
4. Describe the strategies to be implemented and logic of their theory
5. Describe the resources to be applied
6. Note places where there might need to be program transitions (e.g., modifications, where there would be success or failure, etc.)

Logic models go hand-in-hand with program theory in the market transformation literature. Rosenberg and Hoefgen state that “program logic models are graphic representations of the causal links between program activities, short-term responses to those activities among market actors, and longer-term market effects.”²⁶ Logic models serve as an invaluable tool for understanding not only the causal relationships but also the feedback loops and interconnections among various program components (e.g., resources, activities, short- and long-term outcomes, etc.). Rosenberg and Hoefgen found that program administrators used logic models in the following ways to support program planning:²⁷

- Ensure that all key groups of market actors are addressed by one or more program components.
- Ensure that key motivators and barriers for each group are addressed in the program design.
- Formulate indicators of market change that can be used to characterize the baseline and formulate program goals and objectives in a quantitative manner.

²⁴ Sebold et al., “A Framework,” 4-2.

²⁵ Ibid., 4-3.

²⁶ Rosenberg and Hoefgen, “Market Effects and Market Transformation,” 48.

²⁷ Ibid., 48-49.

- Identify gaps in the market data that need to be filled through program-related contacts with market actors or independent data-gathering activities as the program progresses.
- Provide a framework for negotiation among sponsors and evaluators regarding the establishment of quantitative goals for participation and observed market changes.
- Identify areas of overlap and potential synergy among different programs that operate in the same market sectors.²⁸

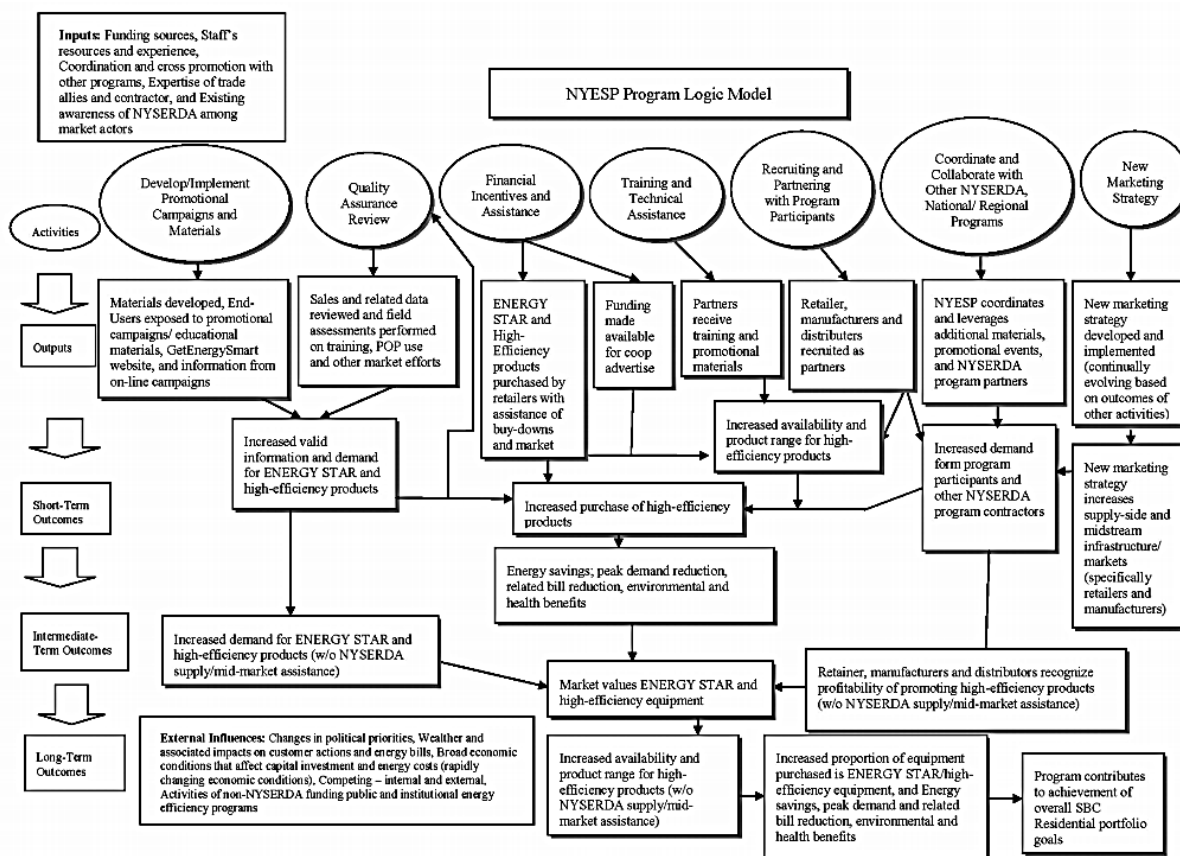
Sebold et al.²⁹ argue that all types of programs should develop logic models, as they are an invaluable tool for visually connecting program activities to desired outcomes, which is a critical step in the planning process for both MT and resource acquisition programs.

All logic models set forth the connections between program elements and desired market outcomes. The best models, however, provide more detail on the need for the program and the indicators that will be used to measure market effects. As Sebold et al. state, “Intervention objectives must fit specific needs.” Each element must also be linked to desired outcomes—including short- and long-term ones. Figure 3-2 below is an example of a program logic model.

²⁸ Rosenberg and Hoefgen (2009) draw this last point from Albert, S., V. Engel, G. Jordan, L. Megdal, and J. Peters, “Using Program Theory and Logic to Improve Design and Likelihood of Real Market Change: Experience with a State Public Benefits Program,” (proceedings of the ACEEE Summer Study, Vol. 6, pp. 1-12, American Council for an Energy-Efficient Economy, Washington, D.C., 2004).

²⁹ Sebold et al., “A Framework.”

Figure 3-2: Example Logic Model



Source: GDS Associates Inc. *Program Theory and Logic Model Activities for the New York Energy Smart ENERGY STAR Products and ENERGY STAR Marketing Programs*. Prepared for NYSERDA. February 2010.

3.1.5.1 Related Practice: Match Program Theory to Market Characterization

A good market characterization must precede the development of the program theory in order to avoid a “faulty understanding” of how the market will respond to program interventions. In general, market transformation programs model their efforts on one of three theories (or a combination of them).³⁰

The first is a theory of the microeconomics of consumer behavior. According to Rosenberg and Hoefgen, “The model focuses primarily on the ways in which programs change circumstances—designated as ‘market barriers’—that lead consumers to forego purchase of cost-effective energy-efficiency measures.” Programs that operate according to this model seek to reduce those barriers to encourage adoption of the measures. The second model aims to increase the rate of adoption of the product or service to make the energy-efficient innovation the “norm” earlier

³⁰ This discussion draws from the work of Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

than without the program, as described in Rogers' theory of the diffusion of innovation.³¹ The third model is based on the microeconomics of supplier behavior, in which programs adopt a strategy that increases competition in the field, thereby leading to increased availability and diversity of energy-efficient products and services.

The energy-efficiency community regularly cites Rogers' work, but it is worth revisiting his terminology and definitions, as the distinctions among the various types of adopters sometimes become muddled in the literature (e.g., with commentators often conflating innovators and early adopters). Rogers identifies five categories of adopters:³²

1. Innovators – Innovators play “a gatekeeping role” in the social system of adopters. They are the first people in a social system to adopt the innovation. Innovators tend to be “venturesome,” technologically savvy, and able to cope with uncertainty.
2. Early adopters – “Early adopters put their stamp of approval on a new idea by adopting it,” explains Rogers.³³ Unlike innovators, early adopters enjoy a fair degree of respect among their peers and the general public. If they embrace a new technology, many others will likely follow suit because they have decreased uncertainty about the innovation.
3. Early majority – Individuals in the early majority look to early adopters for leadership regarding innovation but also may deliberate for some time before embracing a new technology; they constitute a numerically large group. Once an early majority member adopts a technology, other early majority members in her social network are likely to follow.
4. Late majority – Rogers describes late majority members as skeptics. Another numerically large group, they often decide to adopt an innovation due to peer pressure or because of some economic or other necessity to do so.
5. Laggards – According to Rogers, “Laggards are the last in a social system to adopt an innovation.”³⁴ They tend to look toward the past for guidance on their actions and remain suspicious not only of change, but also “of change agents [i.e., individuals promoting increased adoption of the innovation].” They may have very rational and logical reasons for resisting an innovation and must be very sure “that the new idea will not fail before they can adopt.”³⁵

Figure 3-3 presents an overlay of two different curves. The normal curve, shown in blue, provides the distribution of individuals falling into each category of adopter; the red S-shaped curve plots cumulative adoptions. Thus, by the time the late majority begins to adopt the

³¹ Rogers, E. M., *Diffusion of Innovations*, 5th ed. (New York: Free Press, 2003). See also Cohan, D., “MT 101,” and Tiedemann, K., “Evaluation of Market Transformation Programs: An Introduction,” (presentations, ACEEE National Symposium on Market Transformation, Washington, D.C., March 24, 2013).

³² See discussion on page 22 and in Chapter 7 of Rogers, *Diffusion of Innovations*.

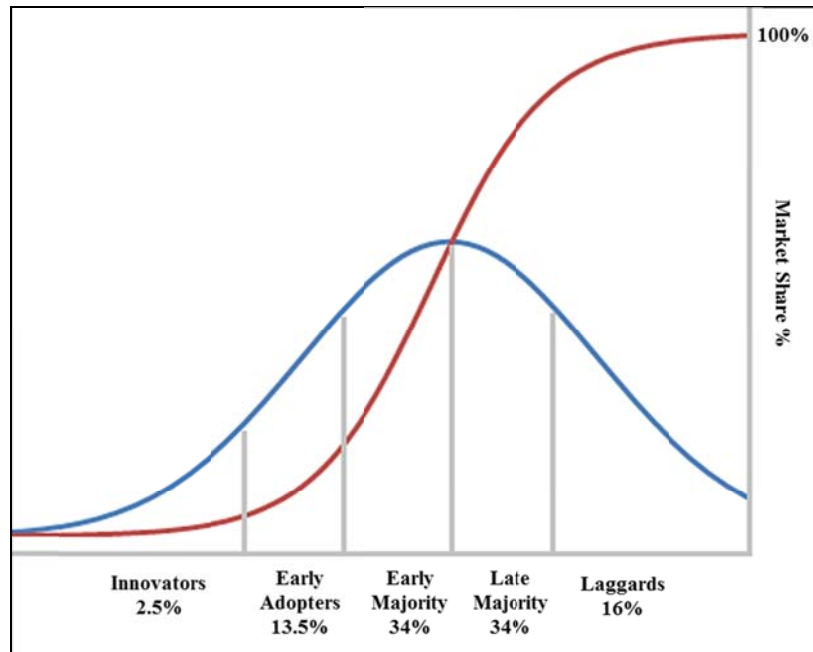
³³ Rogers, 283.

³⁴ *Ibid.*, 284.

³⁵ *Ibid.*

measure, one-half the population—innovators, early adopters, and early majority—have already done so.

Figure 3-3: Rogers' Theory of Diffusion of Innovation



Source: Rogers, E. M. 2003. *Diffusion of Innovations* (5th edition). New York, NY: Free Press.

In practice, MT program designs are frequently based on more than one of these general theories. For example, administrators may promote programs to educate contractors in an effort to increase the number who are certified to install a particular type of efficient system, thereby reducing barriers related to limited access but also increasing competition among suppliers. An approach related to Rogers' theory of the diffusion of innovation relies on social contagion, which espouses the idea that adoption by a few key people can quickly lead other actors to adopt similar technologies and practices as they imitate the key actors—for example, influential builders changing a practice as a result of the program and influencing other builders to change as well. However, such strategies will not work equally well for all types of energy-efficient products or services. The program theory that guides design must match the information garnered from the market characterization described above, increasing the likelihood that program activities will lead to desired outcomes.

3.1.6 Step 6: Develop a Market Transformation Story

Another key step is to develop a “market transformation story”—that is, articulate the linkages between program efforts and the future market state. The market and program logic models offer graphic displays of the presumed links between program efforts and the future state of the market, post-transformation. However, simply drawing an arrow between two boxes does not guarantee that the supposed causal link is actually logical or defensible. The program theory must provide an explicit justification of why and how the program efforts will lead to the desired outcomes. Moreover, this should take the form of a narrative—a story—“that assembles the whole picture of the market and the planned strategy in order to justify the interventions.”³⁶ This narrative should be rooted in information gained through the market characterization study. The importance of the story cannot be understated. As Sebold et al. note, “The only appropriate market transformation targets should be those for which a clear and convincing story can be developed about how intervention will occur, with what effects, and on which schedule.”³⁷ As we describe more below, regular studies that measure the progress of the transformation efforts will provide a way to “check in” on the actual causal linkages between program efforts and desired outcomes. If these studies find that the supposed causal relationship does not actually exist in the operation of the real market, then program theory, logic, and efforts should be adjusted to match the updated understanding of the market.

³⁶ Keating, “Guidance on Designing and Implementing,” 14.

³⁷ Sebold et al., “A Framework,” 3-16.

3.1.7 Step 7: Establish Interim and Long-Term Indicators of Market Effects

Market transformation does not happen overnight; it can take years for market effects to manifest and even longer for them to become sustainable without continued program intervention. Even so, program administrators cannot wait years to see if their efforts are paying off. Therefore, as we discuss more in the evaluation section below, program planners should work with evaluators to establish interim and long-term indicators of market effects that will be tracked over time through regular market assessments. We provide more discussion and examples of interim and long-term indicators in Section 3.2 below.

3.1.8 Step 8: Plan for Exit or Transition

Articulate an exit or transition strategy for when transformation is complete. Collectively, Rosenberg and Hoefgen³⁸ and Keating,³⁹ building on Hewitt,⁴⁰ identify several indicators that would suggest that the program should reduce or withdraw support for the product or service because the market is sustainable on its own, including the following:

- Market actors make a profit by offering the product or service
- Market actors are in the position to continue to facilitate adoption of the product or service
- The profession or trade has adopted the product or service as a standard practice
- Reverting to earlier equipment or practices would be costly
- Manufacturers have resolved product performance issues
- More efficient codes and standards have been adopted
- Efficient product or service has achieved a dominant market share in both the program and non-program areas, pushing out less efficient options
- Customer awareness makes the targeted measure the likely choice
- Product or service enjoys widespread availability
- Price is competitive, and increasingly so

Rosenberg and Hoefgen note that very few programs to date have completely ceased all market intervention; hence, the term *transition strategy* may be more appropriate than *exit strategy*.⁴¹ Programs that have discontinued incentives for products still typically engage in some sort of marketing or education and may even play a role in regional efforts that continue to offer incentives for the product. Other programs limit incentives to the most efficient products (e.g., CEE Tier 3 Clothes Washers or TopTen USA) or gradually reduce the amount of support (e.g., incentives, cooperative advertising) provided for the product or service. Importantly, commentators stress the importance of continuing to track market indicators after the implementation of an exit strategy in order to verify the sustainability of the market. Thus,

³⁸ Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

³⁹ Ibid.

⁴⁰ Hewitt, D., “Elements of Sustainability,” (proceedings of the ACEEE Summer Study, Vol. 6, pp. 179-190, American Council for an Energy-Efficient Economy, Washington, D.C., 2000).

⁴¹ Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

evaluation activities are an integral part of the entire program process, from the earliest stages of planning through design and implementation and continuing even after the program has ceased.

3.1.9 Step 9: Continue to Measure and Monitor Key Market Indicators After Transformation

It is important to measure and monitor key market indicators not just throughout the life of the program, but after a particular market has been transformed. We discuss this tool in Section 3.2 below.

3.1.10 Other Effective Practices

In addition to the above steps, we also identified other important and effective practices, described below.

3.1.10.1 Working with Markets

Recognize and use market forces. The idea is to *engage* the market as it currently exists—to work within the market structure. For example, the Massachusetts ENERGY STAR Lighting Program Administrators formerly relied heavily on a coupon approach, but coupons presented a barrier in that they complicated the transaction at the cash register and required expensive coupon redemption systems on the part of both retailers and program administrators. In response, the program administrators switched to an upstream design, providing incentives to manufacturers and retailers, which was transparent to consumers and simpler to administer. This resulted in a substantial increase—numbering in the millions—of both in-program and out-of-program CFL sales in the state. Moreover, manufacturers and retailers provided their own matching incentives, further boosting program impact and contributing to the still-in-progress transformation efforts.

Find market allies who are willing to work with the program. For example, some homebuilders build close to ENERGY STAR standards even without the program; it is easier to get them to make a few tweaks to their practices in order to fully qualify than to recruit and train builders of less efficient homes. This can lead to early success as measured by program participation, even if early participants are free riders, and they can contribute to the momentum that will draw in other builders.

Promote competition. Programs accomplish this in many ways, with the exact nature of the strategies being dependent on the market and the product. For products sold in retail stores, program administrators recruit partners widely from among manufacturers and retailers, fostering competition within the program, but also in the marketplace. New construction or retrofit programs might host trainings in which potentially competing builders and contractors take part so that all of them can offer customers energy-efficient options.

Share risks with other market actors. As described below, upstream and midstream incentives can be part of market transformation initiatives. They serve as a common example of sharing the risks of carrying and promoting energy-efficient products and services; incentives make efficient products more viable for various market actors. Cooperative advertising, funding of promotional displays, and training of salespeople are all also investments that programs make that offset the risk for other market actors, but with uncertain outcomes for the program.

Use upstream market actors to influence downstream adoption of energy-efficient products and services. The tremendous success of upstream lighting programs in the mid-2000s in the Northeast, the West (including British Columbia), and parts of the Midwest is a quintessential example of how program interventions (e.g., incentives, training, support of quality control testing, point-of-sale materials, etc.) targeted toward upstream and midstream market actors can

greatly expand the adoption of products and services downstream. While lighting programs still hope to achieve higher socket saturation rates, recent studies demonstrate that the vast majority of households in the Northeast use at least one CFL.⁴² In Section 4.3 we discuss the frequency with which the programs we examined use upstream actors to influence downstream adoption of energy-efficient products and services.

3.1.10.2 Framing Benefits

Tie non-energy benefits to the product or service. As discussed earlier, energy efficiency may not be sufficient to persuade some consumers to buy a product; non-energy benefits, however, can help tip the scales in favor of efficiency. Emphasizing comfort and health in retrofit programs, such as NYSERDA's Home Performance with ENERGY STAR program, and improved light quality and long measure life for LED lighting are additional examples of non-energy benefits.

3.1.10.3 Leveraging Resource Acquisition

Leverage Resource Acquisition Tools or Programs. As mentioned earlier, market transformation efforts require substantial investments of time and money. Markets for major residential products and services—new homes, lighting, appliances, and heating and cooling equipment—are very large and can function on their own without the involvement of energy-efficiency programs. At the beginning, even very large MT programs often operate only at the margins of these markets, although later on the programs themselves can become an integral part of the market. The scale of commitment required to move these large and established markets necessitates that programs spend a great deal of money on an MT effort while waiting years to reap the benefits. Regulators, legislators, and the people they represent, however, are often not willing to spend the required resources to capture benefits at some unknown point in the future. Given the size of the markets, the concerted and sustained effort it takes to move them, and the requirements to show progress in the short term, most successful strategic MT programs include some characteristics of resource acquisition programs or work closely with them, typically through the use of incentives at some level in the market. Because MT programs target entire markets, incentives, when used, are typically offered to upstream or midstream market actors in a strategic fashion in keeping with the program logic. NEEA, for example, is organized explicitly to promote market transformation, but after laying the groundwork for market transformation in the region, it frequently leverages rebates or incentives offered through programs run by the utilities and the Energy Trust of Oregon to accelerate the process.

3.1.10.4 Taking the Innovation Adoption Curve into Account

Focus on early adopters in opening markets for innovative products, including energy-efficiency products. This strategy ties closely to Rogers' observation that individuals tend to look toward early adopters (but not innovators) for the stamp of approval before adopting an

⁴² For example, see NMR Group, Inc., KEMA, Cadmus Group, Inc., Tetra Tech, "Massachusetts ENERGY STAR® Lighting Program: 2010 Annual Report, Volume 1: Overall Final Report," June 13, 2011.

innovation: If a program can get early adopters to embrace the energy-efficient product or service, then it is likely that early majority adopters will soon follow. Programs should work closely with market allies to identify the best ways to reach out to early adopters. Some ideas include demonstration projects with key home builders and past program participants.

Avoid the “chasm” between adoptions by innovators and the general public, which for Rogers would include early adopters. In other words, programs need to develop strategies that promote widespread adoption of the innovation rather than having it concentrated among a few gatekeepers. It is important to use different program approaches for innovators and for mainstream markets. The first few innovators may be attracted to a new technology by the “gee whiz” factor or by the idea of being first, but early adopters—the group that can help draw in others—require more substantive reasons to try the technology, such as non-energy benefits (discussed in Section 3.1.10.2).

3.1.10.5 Getting Expert Advice

Form a market-based advisory group to help shape and review the program. As Keating explains, “For an optimal market transformation program planning environment, we recommend that program designers bring in individuals, stakeholders, and private sector companies to form a sounding board and an idea generator.”⁴³

⁴³ Keating, “Guidance on Designing and Implementing,” 16.

3.2 Program Evaluation Practices

The nature of many strategic market transformation efforts increases the challenges of evaluating their effectiveness. As we have documented throughout this paper, it is essential for the success of MT programs that program planners, designers, and implementers work hand-in-hand with evaluators. This section summarizes evaluation practices identified in the market transformation literature as key to the successful evaluation of strategic market transformation.

3.2.1 Match the Evaluation Strategy to the Program Logic

A critical best practice involves matching the evaluation strategy to the program logic. Sebold and his colleagues suggest that the logic model should serve as a clear “roadmap” to the program evaluation activities.⁴⁴ More specifically, “Evaluation and measurement activities should test the logic of the intervention to determine whether the logic makes sense and whether the results of the intervention are consistent with the intervention logic.”⁴⁵ As we have stressed above, this matching ideally occurs during the program planning phase to ensure that program managers and implementers track information necessary for evaluation throughout the implementation period. Again, as Sebold and his colleagues explain, “Evaluations should be planned prior to launch of the intervention to ensure that the intervention can be evaluated, and that the data required to evaluate the intervention effectively are identified and collected at the appropriate time.”⁴⁶

3.2.2 Track Indicators Tied to Expected Outcomes

Evaluation activities should track indicators that clearly link to expected outcomes. As noted in Section 3.1.7 and explained in more detail below, evaluators should track both interim and long-term indicators, and the selection of these indicators should ideally occur during the program planning phase. A best-case scenario involves including the evaluation team during program planning so they can help with the identification of these indicators and the best approaches to measuring them. Identifying such indicators before or coincident with initial program planning also allows the establishment of initial baseline conditions. Importantly, early identification of indicators allows for tracking the information that is critical for evaluation; in other words, it increases the evaluability of the program.

In Section 3.1.1 we mentioned some common market indicators that programs frequently track, such as market share, cost-effectiveness, and net savings. (In conjunction with this study, NMR identified more than 300 market progress indicators across the studies reviewed. These are discussed in Section 4.5.5.) Citing Natural Resources Canada, Pape-Salmon argued that common market progress indicators coincide with the “five A’s of market transformation”.⁴⁷

⁴⁴ Sebold et al., “A Framework.”

⁴⁵ Ibid., 5-1.

⁴⁶ Ibid., 5.

⁴⁷ Pape-Salmon, A., and D. Ross, “Market Transformation Strategy for Windows and Doors in British Columbia” (proceedings of the ACEEE Study on Energy Efficiency in Buildings, 2010). See also NRCan, “Canada’s ENERGY STAR® Market Transformation Awards: The ‘Five A’s’ of Market Transformation,” for original concept.

1. Availability
2. Awareness
3. Accessibility
4. Affordability
5. Acceptance

Based on the work Rosenberg and Hoefgen⁴⁸ and Prahl and his colleagues,⁴⁹ non-A words missing from this list, include market share and net impacts (including its components, free-ridership and spillover, when measurement of these components is possible).

3.2.3 Perform Regular, Ongoing Research into the Status of the Market

Although market transformation generally takes a sustained effort over time, market conditions can change rapidly for reasons both related and unrelated to program efforts. In addition, market effects can sometimes “sneak up” on programs if they are not paying regular attention to market indicators. For these reasons, programs should engage in regular, ongoing research into the status of the market, typically resulting in what the field calls Market Progress Evaluation Reports (MPERs). Regular research into the status of the market plays numerous roles in program implementation and evaluation. Programs may not have to perform each activity described below in every MPER, but they should outline a plan for regular updates for each topic and build flexibility into the evaluation process to address unexpected issues that arise over time. MPERs should include updates of the market characterization and baseline estimates.

The initial market characterization study should be updated once the key indicators are identified. The frequency with which it should be updated depends on how fast the market is changing. For example, the residential lighting market has been changing so fast in recent years that annual market characterization may be advisable, as has been done in Massachusetts. For new construction, a characterization of building practices should ideally be done at the beginning and end of each code cycle.

⁴⁸ Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

⁴⁹ Prahl, R., R. Ridge, N. Hall, and W. Saxonis, “The Estimation of Spillover: EM&V’s Orphan Gets a Home,” (proceedings of the International Energy Program Evaluation Conference, Chicago, IL, August 2013).

3.2.4 Assess Market Effects Periodically

The MPER offers the opportunity to quantify changes in indicators of market conditions and demonstrate causal links between program activities and observed changes in market conditions. In other words, an assessment of market effects provides regular “check-ins” on how the program is operating, on what is working and what is not. The most effective assessments start with a clearly defined set of the market effects to be considered in the evaluation. Evaluators should work closely with program administrators to develop an evaluation plan that focuses on a limited set of market effects in order to keep the scope of the study manageable and cost-effective. Some program administrators have found it useful to address a subset of market effects in each MPER, but target assessment of others at specific times in the program cycle. As mentioned in the planning section, the market indicators under assessment should include both short-term (interim or proximate) indicators that can reasonably be expected to manifest early in a program’s implementation phase as well as long-term indicators that will most likely not become apparent until much later, including “ultimate” indicators of changes in the patterns of adoption, such as market share and saturation.

Short-term indicators can provide regular insight into probable program impacts while also yielding metrics that administrators can use in annual filings to regulators or others who oversee programs. These short-term indicators are among those that are often directly tracked by the program or get measured through annual or frequent evaluation activities. Examples of common short-term indicators include the percentage of households using the targeted product or service, shelf or showroom space devoted to efficient models, and practices learned in trainings held with contractors or salespersons, among many others. Ideally, programs would also regularly track market share for efficient products, but the ability to do so depends heavily on the availability of data on product sales, which manufacturers and retailers generally hesitate to share.

Of course, the program must also identify the long-term, lasting effects it expects to have on the market and a plan on how to measure these effects. While progress toward long-term indicators can be tracked in regular MPERs, the expected outcome will not be realized until the MT efforts have been in place for a considerable time (with the amount of time varying by product and market). Common indicators of long-term market effects include increased demand for the product or service, support for and ultimate adoption of increased codes and standards, and salesperson and contractor promotion of the products and services without program support.

3.2.5 Refine the Program Theory and Logic Model

Sometimes efforts to re-characterize the market and revise the baseline reveal the necessity to update the program theory or logic model. NYSERDA, for example, updates some of its logic models every few years. The market may have changed in fundamental ways such that the original theory and logic do not match current conditions. Some of the market changes—for example, increased federal efficiency standards or the introduction of new products—could actually reflect market effects resulting from transformation efforts. Still, if the market is not yet fully transformed, program administrators may need to work closely with planners, implementers, and evaluators to revise the theory and logic. Of course, they may also need to revise the program efforts as well to match the new conditions.

3.2.6 Assess Attribution

As mentioned earlier, the baseline can mean both the initial conditions in a market before being targeted by a program as well as the counterfactual conditions after the program has been running—what the market would have looked like if the program had not existed, which assumes that the market would not have been static without the program. Comparing the baseline or counterfactual to the actual state of the market provides a measure of market change. Rosenberg and Hoefgen identify four general methods for assessing attribution—that is, to link program activities to identified market change in order to establish causality.⁵⁰ In addition, we identify a fifth method, the last one listed below. The methods are:

1. Self-reported counterfactual analysis: Data are usually gathered for this method through surveys or in-depth interviews asking about free-ridership and spillover, provides one approach to assessing attribution to the program. However, only upstream market actors, not end-users, can be expected to answer questions about nonparticipant spillover in a meaningful way.
2. Cross-sectional comparison: This involves identifying one or more comparison groups that will be tracked along with the program area. The comparison group serves as the “baseline” in studies that rely on this method. Importantly, the comparison group may be a randomly assigned control group or a quasi-experimental group in which individuals are not randomly identified but have collective characteristics that are similar to those of the program group. The analysis can be performed using sales data and/or survey data. A special type of cross-sectional comparison involves using statistical modeling to describe pre-program conditions or what conditions would be like in the absence of a program. While the approach could certainly benefit from data collection performed early during planning or early implementation stages, with careful model specification, evaluators have successfully developed such models well into program implementation. Successful efforts include models describing market share of ENERGY STAR appliances in the Northeast and CFL sales in program areas

⁵⁰ Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

- across the nation.⁵¹ There can also be time series cross-sectional analysis of changes over time among different groups; this can be a simple comparison or could involve statistical modeling.
3. Historical tracing: Sometimes referred to as theory-based evaluation, historical tracing is primarily a qualitative approach to establishing attribution that involves a narrative description of the linkages between program actions and market changes. Ideally, this approach would rely on a range of information, including tracking of market indicators beginning before the advent of the program. Such tracking has been carried out by BC Hydro, Massachusetts, and NEEA for residential lighting⁵² and NEEA for the Northwest ENERGY STAR Homes program.⁵³ The report on the 2007 Massachusetts Lighting Program provides a narrative to argue for program effects on the market.⁵⁴
 4. Structured expert judgment, typically through the Delphi process: In the Delphi process, evaluators identify a team of experts who review information on the market for the energy-efficient product or service. The team then answers a series of questions about the baseline conditions in the market and returns them to the evaluation team. Critically, the evaluation team compiles the information and then sends the compiled insights back to the expert panel. The panelists then have the opportunity to revise their estimates based on the insights of their colleagues or to remain firm with their original contributions. The evaluation team finalizes baseline estimates based on the final judgments of the panelists. In practice, a Delphi approach may be used in conjunction with other methods. Recent examples include codes and standards programs, residential lighting, and residential new construction. For example, the Massachusetts Program Administrators are currently using a new Delphi study, in conjunction with characteristics of new housing collected onsite, to estimate the counterfactual—what would have happened in the absence of the program—and to subtract modeled with-program energy use from modeled counterfactual energy use to estimate the net savings attributable to the residential new construction program.⁵⁵ Several years ago, the Massachusetts Program Administrators asked a

⁵¹ Rosenberg, M., “The Impact of Regional Incentive and Promotion Programs on the Market Share of ENERGY STAR® Appliances” (proceedings of the International Energy Program Evaluation Conference, 2003). Feldman, S., L. Wilson-Wright, L. Hoefgen, and A. Li, “Modelling the Effects of U.S. ENERGY STAR® Appliance Programs” (proceedings of the European Council for an Energy Efficient Economy, Summer 2005). NMR, Cadmus, and others: multistate CFL modeling for various program administrators, notably Connecticut (2010), Massachusetts and NYSEDA (2010, 2011), and Rhode Island (2011).

⁵² Tiedemann, K., 2013. NMR et al., 2008. EcoNorthwest, “Residential Lighting Program: Final Market Progress Evaluation Report” (August 15, 2004). KEMA, “2011-2012 Northwest Residential Lighting Tracking and Monitoring Study” (September 2012).

⁵³ Evergreen Economics, 2012.

⁵⁴ NMR (formerly Nexus Market Research, Inc.), RLW Analytics, and Dorothy Conant, “Market Progress and Evaluation Report (MPER) for the 2007 Massachusetts ENERGY STAR® Lighting Program,” (July 1, 2008). See in particular the section “Market Effects and Attribution to the Program.”

⁵⁵ In process; report not yet available.

- Delphi panel to develop a ten-year forecast of the market share of ENERGY STAR-labeled homes assuming the following: a) termination of all public support of the program (that is, a forecast of the non-intervention baseline), b) maintenance of current programs for five years, and c) maintenance of current programs plus additional incentives for builders provided by federal legislation.⁵⁶
5. Estimating the non-intervention baseline: Evaluators estimate how the market would behave without intervention, which is then compared to what happened with the program to develop net savings estimates. One version of this is NEEA's "Current Practice Baseline":

At any point in time, customers are making decisions on equipment purchases, design features, or operational practices. The average efficiency that results from these decisions constitutes an estimate of what would have happened in the absence of NEEA's initiatives. This is referred to as the current-practice baseline in the *RTF Guidelines* and represents the counterfactual. The difference between the efficient equipment that NEEA promotes through its initiatives and the counterfactual (which varies by measure) constitutes the savings that NEEA has caused. Any additional adjustments, such as the application of a net-to-gross ratio, are unnecessary.⁵⁷

Another way to estimate the non-intervention baseline is to use prior market trends to estimate a natural adoption curve (as described by Rogers⁵⁸ and presented in Figure 3-3 above) that describes how the market would behave without intervention.⁵⁹ For DTE Electric, Navigant used national and DTE-specific saturation data and applied a diffusion curve to backcast the saturation that would have existed in DTE's service territory in 2012 in the absence of the program. The result was compared with data reflecting actual saturation of CFLs in DTE territory in 2012 to develop a NTG estimate.⁶⁰

3.2.7 Calculate Net Savings at the Market Level

3.2.7.1 Traditional Approach: Program-Level Net Savings

Of the five methods discussed in the previous section, self-reported counterfactual analysis, with its focus on free-ridership and spillover, is the only one that necessarily calculates a NTG ratio at

⁵⁶ Blake et al., 2003.

⁵⁷ Ridge et al., "Gross is Gross and Net Is Net: Simple, Right?" (IEPEC 2013).

⁵⁸ Rogers, *Diffusion of Innovations*.

⁵⁹ Sebold et al., "A Framework." Cohan, "MT 101" and Tiedemann, "Evaluation of Market Transformation Programs."

⁶⁰ Navigant Consulting, Inc., "Standard CFL Net-to-Gross Research: CFL Market Model Method" (in review, prepared for DTE Electric, Inc., 2013)

the *program* level. However, it continues to be the most common approach by far. The traditional formula⁶¹ for calculating a net-to-gross (NTG) ratio at the program level is as follows:

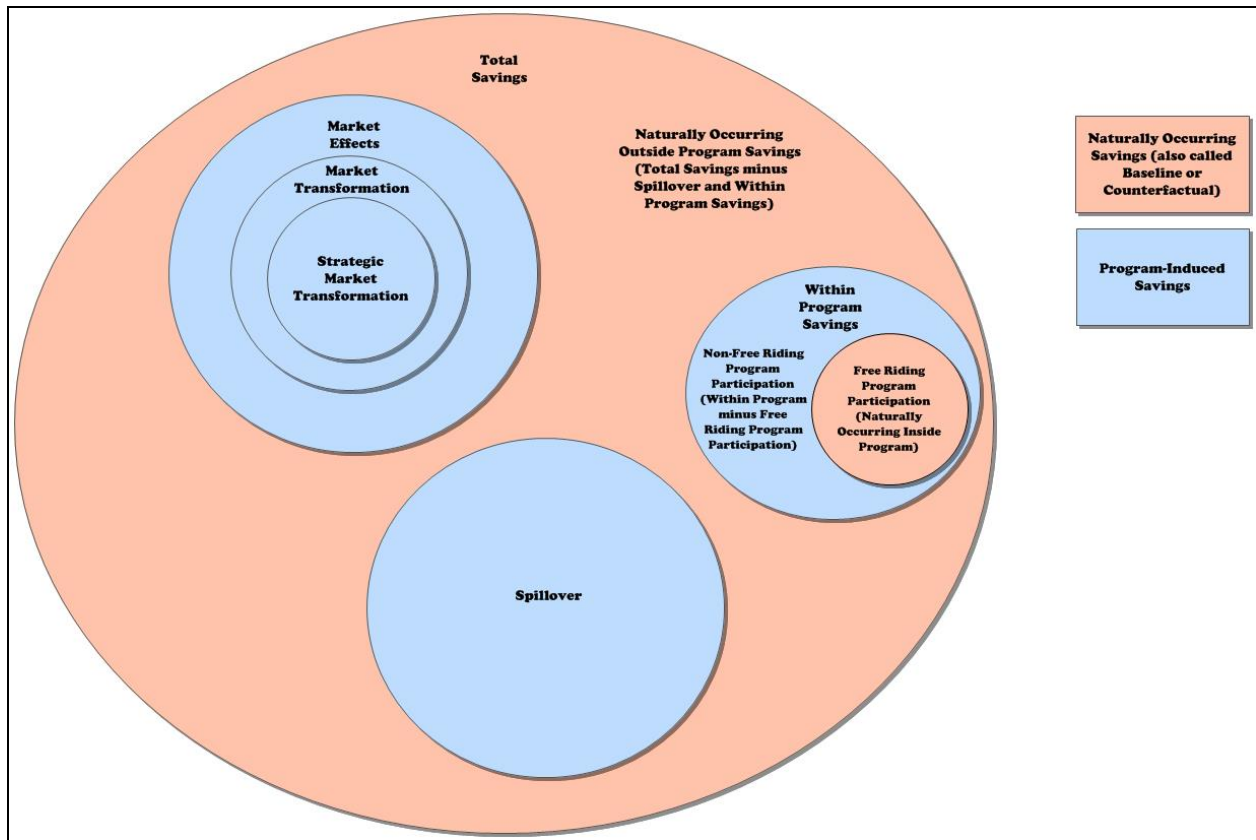
$$NTG = 1 - FR + SO$$

Some practitioners have argued that this traditional equation—and the ways in which free-ridership (FR) and spillover (SO) are typically measured—underestimate market effects.⁶² This has led some evaluators to modify the above equation by treating market effects as an add-in, as follows:

$$NTG = 1 - FR + SO + ME$$

This approach defines market effects as separate from spillover, as depicted in Figure 3-4. This program-level approach to net savings estimation emphasizes separating the components as much as possible.

Figure 3-4: Program-level Conceptualization of Net Savings



In the simplest terms, in this approach spillover is savings occurring outside a program due to the influence of the program. Market effects are savings stemming from changes to the structure and functioning of a market that are due to the influence of a program. Market transformation is sustained or lasting market effects.

⁶¹ FR=Free-ridership. SO=Spillover.

A major problem with treating market effects as separate from spillover in this manner is the difficulty of avoiding double counting. While a program is going on, there is likely to be some spillover that is not market effects, such as breakage (customers intending to cash in a rebate, but never getting around to it), or participants taking additional actions outside the program that reduce energy use, but as a direct result of program participation. Much spillover, however—including most, if not all, spillover that occurs after program activity is eliminated or reduced—is difficult to distinguish from market effects. For example, savings due to changes in stocking practices in response to a program can and has been counted as spillover; it also seems to be a change in the structure and functioning of the market, and therefore constitutes a market effect. The overlap is considerable, but spillover is the more general term and appears to encompass market effects.

It is also important to note that some types of market transformation programs (e.g., those focused on education and training) may create conditions that could be identified as “free-ridership.”⁶³ For example, a consumer may be exposed to program-supported education about a particular product and decide to buy it because of that education. If that person uses an incentive from a separate, second program to buy the item, the purchase could be considered “free-ridership” from the perspective of the second program when it is instead spillover from the first program that supported the educational effort. This leads some commentators, including Mahone and Hall, to argue for portfolio-level approaches to measuring attribution in order to take cross-program effects into account. Without changes in the approaches to measuring free-ridership, they fear that program administrators will not pursue the innovation strategies needed to achieve deep and lasting energy savings.

3.2.7.2 Emerging Approach: Market-Level Net Savings

Based on NMR’s experience with market effects measurement for residential programs throughout North America, it appears that an increasing number of market effects studies calculate the net-to-gross ratio at the *market* level, using the following formula:

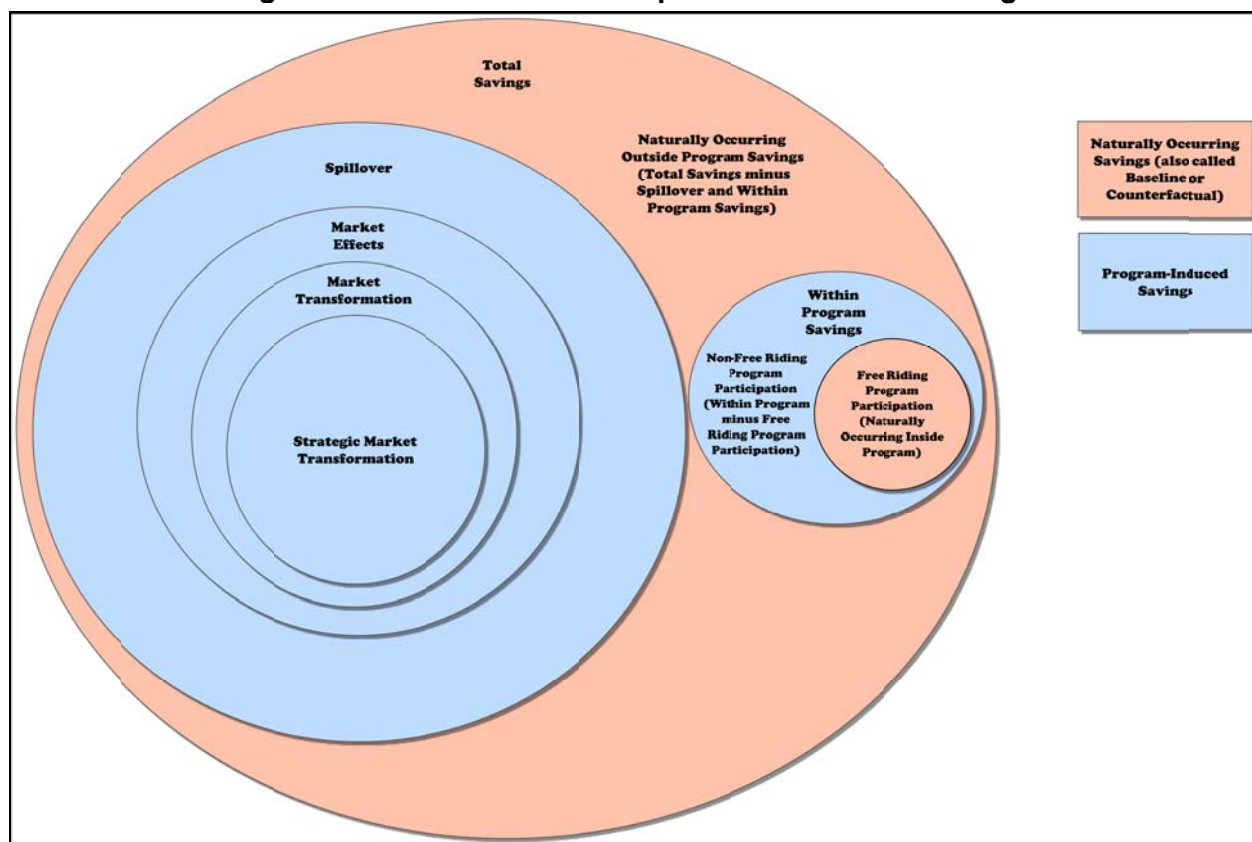
$$\text{NTG} = (\text{total savings} - \text{naturally occurring savings}) / \text{within-program savings}$$

This conceptualization, as represented in Figure 3-5, attempts to estimate only two components: naturally occurring savings and program-induced savings (assuming that within-program savings are known). Free-ridership is not measured, nor are market effects calculated separately from spillover, which avoids the double-counting problem inherent in adding a market effects savings estimate to a traditional net savings estimate depicted above in Figure 3-4. NEEA’s Current Practice Baseline approach is a variant of this approach with a somewhat different formula but the same focus on the market level:

$$\text{Net savings} = \text{Naturally occurring energy use} - \text{With-program energy use}$$

⁶³ Mahone and Hall, “Proceedings of the ACEEE Study on Energy Efficiency in Buildings” (2010).

Figure 3-5: Market-level Conceptualization of Net Savings



3.2.8 Assess Sustainability and Prepare for Exit or Transition

Evaluators should review the indicators of market sustainability in the absence of the program to determine if the program should be eliminated, be scaled back, or change its focus.

3.2.9 Tell the Market Transformation Story

Calculating net savings at a market level can be done quantitatively, albeit with many caveats, given the need to estimate something that did not happen—namely, naturally occurring savings (also called the counterfactual because it is counter to fact). An important part of evaluation of strategic market transformation efforts, though, is qualitative, which takes us back to the market transformation story (3.1.6) and the tracking of indicators (3.1.7). A useful tool in this process is historical tracing or theory-based evaluation. As described above, historical tracing uses information from a wide range of sources and reconstructs events leading to an outcome of interest to develop a “weight of evidence” conclusion regarding the influence of the program. If the market transformation story told at program inception is borne out by events—if, based on a preponderance of evidence, key indicators change in the way the theory had predicted with confirmation that they are linked to program actions, and if the program-induced changes in the market appear to be sustainable—then it seems reasonable to say the market has been transformed due at least in part to program activity. In the meantime, before substantial changes are achieved, qualitative confirmation that the market transformation story is playing out

according to script should provide confidence to program administrators and regulators that continued program activity and funding are justified.

3.2.10 Continue Tracking Market Effects after the Program Has Ended

Program administrators should allocate resources to continued tracking of the market after the program has ended. Such tracking allows the administrator to assess the sustainability of the market effects in the absence of program intervention. Although the market may initially show some symptoms of the removal of support, overall a transformed market should quickly recover from these short-term difficulties without the aid of intervention. Of course, if market indicators persist in showing declines after program cessation, transformation may not have been complete, suggesting the need for some program re-entry into the market.

NEEA has shown leadership in continued market tracking after program cessation. For example, KEMA performed continued CFL market tracking for NEEA after the organization stopped supporting the energy-efficient bulb in 2008. KEMA documented a 15% decrease in CFL sales between 2010 and 2011, leading to a recommendation that NEEA work with individual energy-efficiency program sponsors in the region to develop a common approach to CFL promotion and consumer education. KEMA did not, however, recommend that NEEA offer those incentives.⁶⁴

⁶⁴ DNV KEMA Energy & Sustainability, “2011-2012 Northwest Residential Lighting Tracking and Monitoring Study” (report #E12-243, 2012).

4 Review of MT Program Practices Implemented

This section contains a summary of information gleaned from the in-depth interviews and a review of publicly available program reports for a subset of the strategic MT programs listed below. It also describes the rate at which the practices described in Section 3 appear to have been carried out for the 14 programs reviewed for this study. It addresses the following topics for each of the program administrators: 1) definitions of MT, 2) planning and research approaches, 3) common MT strategies, 4) perspectives on program success and progress toward MT, 5) MT evaluation approaches, 6) exit or transition strategies, 7) policies and other considerations affecting MT efforts, and 8) lessons learned.

As Section 2 describes in more detail, NMR selected eight programs from across the five residential program areas covered in this study (lighting, products such as plug load and appliances, home performance, whole house, and HVAC) and the four program administrators for a more thorough investigation via in-depth interviews with program staff. Three of these four program administrators identify market transformation as an explicit organizational goal or program strategy within their portfolio. The eight programs are:

- Efficiency Vermont's Home Performance Program and Residential New Construction Program
- The Massachusetts Program Administrators' ENERGY STAR Lighting Program
- NYSERDA's New York Home Performance with ENERGY STAR Program and New York ENERGY STAR Certified Homes (NYESCH) Program
- NEEA's Consumer Electronics TV Initiative, ENERGY STAR Clothes Washers Initiative, and Ductless Heat Pump (DHP) Initiative

Short descriptions of each of these programs and their logic models can be found in Appendix A. NMR reviewed documents for an additional six strategic market transformation programs in the course of the research. The strategies and other information about the additional programs can be found in the tables in Appendix B.1.

The names of the programs reviewed for the study appear in abbreviated form in the tables in this section, as shown in Table 4-1.

Table 4-1: Full Names of Programs Abbreviated in Tables

Program Area and Abbreviated Name		Full Program Name
Lighting	Efficiency VT	Efficiency Vermont Retail Efficient Products Program (Lighting)
	MA Program Administrators	Massachusetts ENERGY STAR Lighting
	NEEA	NEEA ENERGY STAR Residential Lighting Program
Products	Efficiency VT (Appliances)	Efficiency Vermont Retail Efficient Products Program (Appliances)
	NYSERDA (Products)	NYSERDA New York Energy Smart Products Program (Appliances and Consumer Electronics)
	NEEA (TV)	NEEA Consumer Electronics TV Initiative
	NEEA (Clothes Washers)	NEEA ENERGY STAR Resource-Efficient Clothes Washer Program
Whole House	Efficiency VT	Efficiency Vermont Home Performance with ENERGY STAR
	NYSERDA	NYSERDA New York Home Performance with ENERGY STAR (HPwES)
New Construction	Efficiency VT	Efficiency Vermont Residential New Construction
	NYSERDA	NYSERDA New York ENERGY STAR Certified Homes Program
	NEEA	NEEA Northwest ENERGY STAR Homes Program
HVAC	NYSERDA	NYSERDA ENERGY STAR Products Upstream HVAC Partners Program
	NEEA (DHP)	NEEA Northwest Ductless Heat Pump Project

The information below is organized within broad topic areas alphabetically by program administrator. Unless otherwise noted, all information in this section is from in-depth interviews. Due to time constraints, not every interviewee was able to answer every question.

4.1 The Program Administrators and their Market Transformation Objectives

Efficiency Vermont administers statewide energy-efficiency programs for the state of Vermont under an order of appointment issued by the Vermont Service Board. It is operated by a private non-profit organization, the Vermont Energy Investment Corporation.⁶⁵ One of Efficiency Vermont's three major organizational objectives is to "transform the marketplace to make efficiency the standard."⁶⁶

The Massachusetts Program Administrators comprise six investor-owned utilities (Berkshire Gas, Columbia Gas, National Grid, New England Gas, NSTAR/Western Massachusetts Electric [recently merged], and Unitil) and one local inter-governmental organization (Cape Light Compact). Unlike the other organizations with strategic market transformation programs examined in this study, the Massachusetts Program Administrators do not have market transformation as an explicit goal. Three Massachusetts Lighting Program interviewees understood that neither the State of Massachusetts nor the Massachusetts Program Administrators have a formal definition of MT programs or of MT. However, the Massachusetts Lighting Program examined for this study was described by its sponsors as "both a resource acquisition and a market transformation program."⁶⁷ (One interviewee involved in multiple programs in the state opined that in Massachusetts, any program with a greater potential for market effects than most others programs would be considered a MT program. At the same time, this interviewee noted that since MT is considered to be a positive program attribute, program administrators tend to frame almost everything as MT, whether it truly is or not.)

The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation that administers residential energy-efficiency programs for much of New York State. NYSEDA defines market transformation programs as those that "promote energy efficiency by developing markets and permanently change energy-related decisions by residents, retailers, and manufacturers." MT programs "create an energy-efficiency 'ethic,' whereby consumers' decisions are made based on life-cycle economic benefits and costs and sustainable environmental stewardship." MT programs also aim to "develop the energy-efficiency supply infrastructure through training, certification, marketing and other means." MT is one of several strategies employed in programs within NYSEDA's portfolio. NYSEDA also offers "resource-acquisition programs [that] identify energy savings opportunities and install energy-efficient products and technologies in small homes, multifamily buildings, commercial buildings, industrial plants, and other facilities."⁶⁸

⁶⁵ Efficiency Vermont, "About Efficiency Vermont," accessed October 13, 2013, http://www.encyvermont.com/about_us.aspx.

⁶⁶ Efficiency Vermont, "Annual Plan 2013" (prepared for the Vermont Public Service Board, November 1, 2012).

⁶⁷ Nexus Market Research, RLW Analytics, Dorothy Conant, "Market Progress and Evaluation Report (MPER) For the 2007 Massachusetts ENERGY STAR® Lighting Program" (July 1, 2008, Volume 1 Findings and Analysis).

⁶⁸ New York's System Benefits Charge Programs Evaluation and Status Report: Year ending December 31, 2011. This description is for the period that this study addresses this program, 2002-2007.

The Northwest Energy Efficiency Alliance (NEEA) is a non-profit alliance of more than 100 Northwest utilities and energy-efficiency organizations. It develops and implements market transformation “initiatives” in Washington, Oregon, Montana, and Idaho.⁶⁹

Efficiency Vermont, the Massachusetts Program Administrators, and NYSERDA all report to state regulatory bodies and must adhere to their states’ regulatory requirements. In contrast, NEEA reports only to its Board of Directors and to funding organizations, many of which do not report to state regulatory bodies. Thus, NEEA may have greater freedom in the design, implementation, and measurement of outcomes from MT initiatives than many other program administrators, including the other administrators interviewed for this study.

NEEA defines *market transformation* as “the process of strategically intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice.”⁷⁰ NEEA describes the attributes of its MT initiatives as follows. (It is important to note that this description includes many of the practices described in Section 3 as well as key identifying characteristics of MT discussed in Section 1.2.) NEEA MT initiatives:

- Involve taking “a long-term view of a specific but complete market and the opportunities that exist within that market to increase efficiency.”
- Are complete only “when all of the achievable efficiency opportunities have been adopted into the market or the remaining market barriers are insurmountable.”
- Are iterative—that is, they are carried out in four phases that are repeated over time as the market evolves: (1) identify market barriers; (2) assess opportunities and leverage points; (3) develop and implement market interventions; (4) evaluate and adapt initiatives to the evolving market.
- Intervene in the market strategically—that is, they are “sequenced and targeted to specific market barriers and market actors at the appropriate stages of the market adoption curve” to ensure “that the successes build upon each other.”
- Are market-specific—that is, each program addresses “a specific market made up of definable market actors and decision makers on both the supply and demand side of the market.”
- Result in sustainable change in the market that will continue after the intervention is withdrawn.
- Are about behavior change, specifically “changing the behavior of both supply-side and demand-side market actors.”
- Focus deliberately on market barriers and opportunities.
- Are “designed to result in either increased market adoption compared to what would have happened” or acceleration of the time of adoption—or both.

⁶⁹ Northwest Energy Efficiency Alliance, “NEEA’s Definition of Market Transformation,” accessed September 23, 2013, http://neea.org/docs/marketing-tookits/neea_definition_of_markettransformation.pdf?sfvrsn=0.

⁷⁰ Northwest Energy Efficiency Alliance, “2010–2014 Strategic Plan,” 2009.

- Are “complete when the market incorporates all cost-effective efficiency opportunities as standard market practice.”⁷¹

Three of these four program administrators identify market transformation as an explicit organizational goal or program strategy within their portfolio. While Efficiency Vermont does not explicitly define MT, its MT goal—“to transform the marketplace to make efficiency the standard”—suggests that Efficiency Vermont shares with the NYSERDA and NEEA definitions of MT that it is a permanent change in the market, affecting standard practice or behavior. Both NYSERDA and NEEA also describe MT programs as being about changing demand-side as well as supply-side actors. NYSERDA’s definition describes MT programs as focusing on developing an energy-efficiency “ethic” in consumer decision-making, and on developing supply-side infrastructure through means such as training, certification, and marketing, while NEEA’s definition focuses on behavior change. Significant differences between the two are that NEEA defines MT programs as being designed to transform the market, intervening strategically, with a focus on addressing a specific, clearly defined market. Of the three definitions and four organizations, NEEA’s definition of MT is most similar to that of Prah and Keating.

⁷¹ Northwest Energy Efficiency Alliance, “NEEA’s Definition.”

4.2 Approaches to Program Planning and Supporting Formative Research

4.2.1 Efficiency Vermont

Efficiency Vermont's strategic planning group is responsible for program planning. The group uses a formalized planning process that requires each program to develop or update a "Market/Initiative Brief" annually. The template guides program staff in developing what is essentially the program theory. Neither Efficiency Vermont logic models nor the "Market/Initiative Brief" template are publicly available. For a detailed description of the "Market/Initiative Brief" template, see Appendix A.

4.2.1.1 Market Research

The Vermont Public Service Department is responsible for program evaluation in Vermont, including market research. For the residential programs, market research generally focuses on market characterization and baseline studies of existing homes and new construction, which are conducted every three years. These studies describe the characteristics and performance of existing and new housing stock in the state and are used to assess program progress toward goals as well as to provide input into the planning process. The Public Service Department also commissions evaluations of specific Efficiency Vermont programs, including both process and impact evaluations.

Apart from these market studies and program evaluations, the Vermont Public Service Department does not typically commission research designed to uncover market barriers and motivations to inform program planning. Efficiency Vermont has a limited budget for market research, so it tends to conduct smaller, informal studies such as focus groups and round tables. Efficiency Vermont relies heavily on studies conducted by larger program administrators to understand the general market; it also surveys participating customers and contractors on an ongoing basis. Upon review of the market characterization/baseline studies for existing homes and residential new construction, it is NMR's opinion that they provide little knowledge of who influences whom, how profits are made, where added value occurs, how pricing is done, and where the barriers and potential leverage points might be, and do not provide enough basis for a graphic market model. Rather, they are meant to provide measurement of the efficiency of new and existing housing stock.

4.2.1.2 General Approach to Researching and Selecting Markets, Products, and Services

In researching the markets in which to intervene and the products or services to support, Efficiency Vermont focuses on emerging markets where there is potential for high savings and ratepayer benefit. For residential programs, the Vermont Public Service Department market characterization studies represent market overviews. Efficiency Vermont uses the Total Resource Cost test as a screening tool.

4.2.1.3 Market Actor Involvement in Planning

The Efficiency Vermont residential programs about which staff were interviewed were established prior to these staff members joining Efficiency Vermont, so staff could not shed much light on market actor involvement in the initial planning of these programs. However, one interviewee assumed that the same market actors who now provide input on program changes were likely to have provided input during the planning of the program: builder partners, a Vermont home builders association, the local utility partners (Vermont Gas Systems and Burlington Electric), and the Public Service Department.

4.2.2 Massachusetts Program Administrators

4.2.2.1 Initial Market Research for the Program

While some interviewees among the Massachusetts Program Administrators had been involved with the statewide residential ENERGY STAR Lighting Program (hereafter the Lighting Program, the only Massachusetts program on which we focus) since prior to its launch in 1998, most had difficulty recalling market research conducted as part of the program planning process. However, one interviewee pointed to the 2001 MPER Plan for the Lighting Program,⁷² which includes information about the Northeastern residential lighting market based on a baseline study performed in 1998.⁷³ The report discusses the size of the market, current levels of efficient lighting use, important market actors, and results from a consumer survey about CFL purchasing. The report also points out important baseline data needed for program planning and evaluation that were not available at the time, such as socket saturation.

With the exception of this report described above, little market research appears to have been conducted in the planning phase. One interviewee noted that there was relatively little budget for market research during the period being investigated for the program. Another interviewee noted that early on, when the utilities were trying to determine how to meet growing goals and were considering refocusing the program upstream, they involved market actors in planning by holding lighting summits with retailers and manufacturers. As manufacturers and retailers became program partners, they began to provide input that affected the program design. According to one interviewee, NEEP introduced the concept of an upstream approach for lighting to the Massachusetts Program Administrators and managed the first round of RFPs for the program.

When asked about lessons that the Massachusetts Program Administrators have learned from implementing this program, one interviewee emphasized the importance of characterizing the market (practice 3.1.2), saying that if a program has “significant MT content”—even if it is not framed as an MT program or part of an explicit MT policy framework—the program administrator should conduct a market assessment up front to ensure that he or she understands the market while designing the program. This interviewee further argued that the program administrator should also conduct market assessments at regular intervals to know how the market is changing and make appropriate changes to the program or evaluation design in response.

⁷² Nexus Market Research, Dorothy Conant, Research Into Action, Ben Bronfman, and Shel Feldman Management Consulting, “Multi-Year Market Progress Evaluation Reporting (MPER) Plan for the Massachusetts Residential Lighting Program,” (submitted to Massachusetts Electric Utilities, 2001).

⁷³ Opinion Dynamics Corporation and Regional Economic Research, “Baseline Study of the Northeastern Residential Lighting Market” (1998). Summarized in Hoefgen, Lynn, “Measuring and Targeting Market Transformation in the New England Residential Lighting Market,” (*Electric Perspectives*, July 1999).

4.2.2.2 General Approach to Researching and Selecting Markets, Products and Services

When asked how the Massachusetts Program Administrators typically go about planning for new programs, one interviewee described an approach that involves early, informal research with market actors. The interviewee explained that if incentives are to be involved, typically the program administrators develop these incentive levels first, since this is often what most interests trade allies. Then the program administrators speak with potential market actors to learn about possible delivery models. Using the information they obtain, they develop a delivery mechanism and create a marketing plan, and then obtain feedback on these and adjust them based on the feedback.

According to the same interviewee, the typical approach to research when choosing a product or service to support involves one of the following: 1) first performing an evaluation, such as evaluating a pilot program, 2) monitoring installations to assess savings, or possibly 3) using third-party information to assess the product or service. As not all ENERGY STAR products are created equal, often when the program administrators assess products, they ask for samples, test them, and then decide based on actual performance which products to support.

Another interviewee described a less systematic approach. From this interviewee's perspective, market segmentation and other research to support programs often takes place after a program has begun, as the utilities begin to better understand the market. For example, in recent years high net-to-gross ratios have driven the program administrators to investigate the "hard to reach" market as a new area of focus for the program.

4.2.2.3 Market Actor Involvement in Planning

The Massachusetts Program Administrators tend to rely on their program implementation contractors and on a regional, energy-efficiency, non-profit organization—the Northeast Energy Efficiency Partnerships (NEEP)—to provide program planning recommendations and advice. Because the implementation contractors are engaged with industry on an ongoing basis, they are in a position to help distill the needs of industry into actionable recommendations for the program administrators. NEEP researches, develops, and recommends program strategies for consideration by program administrators in the region. NEEP first introduced the upstream lighting concept into the Northeast and managed the first upstream round of RFPs.

4.2.3 NYSERDA

4.2.3.1 Market Research

According to NYSERDA interviewees, the timing of market research is a function of input from the New York Department of Public Service, program staff, and previous evaluation findings. Interviewees for the Home Performance with ENERGY STAR Program (hereafter Home Performance Program) noted that NYSERDA performed a pilot study for this program prior to full program launch in 2001.

4.2.3.2 Selecting Markets, Products and Services

NYSERDA's Home Performance Program is subject to tests of cost-effectiveness for the program as a whole. Since 2011, it has also been subject to tests of cost-effectiveness at the level of individual measures.

NYSERDA's New York ENERGY STAR Certified Homes (NYESCH) program utilizes the U.S. EPA ENERGY STAR Certified Home platform with New York enhancements.

4.2.3.3 Market Actor Involvement in Planning

The foundation of the Home Performance Program is to take a comprehensive, building science-based approach to delivering energy-efficiency upgrades to existing homes. The implementation contractor, Conservation Services Group, as well as other market actors (EPA, DOE, and participating contractors), provided design input.

For the NYESCH Program, the NYS Builders Association's Research & Education Foundation provided input at the planning stages and also served as a program support contractor in the early years of the program. EPA and the implementation contractor, Conservation Services Group, also provided design input.

4.2.4 NEEA

A NEEA staff person described the development process for its MT initiatives. The steps, in order, are:

1. Identify the market transformation objective.
2. Identify the market barriers to achieving the objective.
3. Identify the market opportunities and leverage points (that is, relationships in the market that could help accelerate the work).
4. Identify strategic market intervention strategies that will capitalize on the opportunities and leverage points.
5. Conduct third-party evaluation to map progress against market progress indicators and confirm that the barriers were correctly identified.

When asked about lessons learned from implementing its MT initiatives, a NEEA interviewee emphasized that it is important, when characterizing the market, to clearly define the target market for the program, the long-term goals, and the barriers that impede market transformation (practice 3.1.2), and to set baselines (practice 3.1.3). According to the interviewee, setting baselines is critical, as you need to have a good sense of where the market is when you begin so you can be confident in how to attribute savings moving forward.

This interviewee also emphasized the importance of thinking long-term, advising that in planning MT initiatives, program administrators should identify their long-term objectives, set long-term goals, and work backward from these. They should consider barriers that will need to be removed, or intervention strategies that need to be in place, in order to achieve the long-term goals, and then consider medium- and short-term goals. Program administrators should make sure they identify the right opportunities and leverage points or times in the market. (For example, the recent TV technology switch was a market opportunity that enabled energy savings to be amplified.)

4.2.4.1 Market Research and Selection of Markets, Products, and Services

When investigating possible new market transformation initiatives, NEEA looks for areas of untapped energy savings potential with market barriers that impede achieving the potential. NEEA has an emerging technologies team of project managers who are responsible for scanning the market for new technologies with energy-efficiency potential and investigating the potential in light of the Northwest Power and Conservation Council's power plan.

NEEA performs extensive research prior to entering a market. Typically, this involves:

- Conducting one or more market characterization studies. These answer questions such as where the product or service is purchased and what the current barriers are to purchasing it.
- Conducting a third-party-evaluated assessment of the naturally occurring baseline.
- Vetting of technology through testing and validation.

The research chosen depends on the product or practice for which the initiative aims to affect the market. In the case of Ductless Heat Pumps, the initial research focused on proving that installing the product a certain way would yield energy savings. With TVs, NEEA already knew there was demand, so the focus was on researching where the market would likely go without the program. In the case of clothes washers, the research focused on behavior, such as determining if consumers would be willing to bend down to take clothes out of a front-loading washer. A primary function of NEEA market research is to identify barriers to the adoption of products or services. How to go about this differs from situation to situation.

4.2.4.2 Market Actor Involvement in Planning

According to one NEEA interviewee, market actors are constantly involved in finessing the organization's initiatives, and NEEA considers them to be partners from the very beginning of an initiative. The intelligence they obtain from market partners helps to shape their timing, strategies, and approaches. As this interviewee put it, "The thing I love about MT is that you're working in partnership with these players to move markets and sometimes you're driving and sometimes they're doing something in the market that's making you completely have to re-shift strategy and approach. . . . We have to be nimble . . . and [to] leverage our partnerships in the market to be able to achieve these [initiative] goals." For example, a goal of NEEA's Heat Pump Water Heater initiative is to influence a federal standard for water heating. One of the first activities of the initiative was to create a specification for heat pump water heaters for use in northern climates. NEEA then took the specification to manufacturers to find out if such a product could be manufactured and what the implications of the specification might be for business, manufacturing, etc.

4.2.5 Planning and Research Practice Insights from Interviews and Program Report Reviews

In the interviews, all the program administrators described some level of involvement in program planning by market actors—an element of recognizing and using market forces (Section 3.1.10.1) to achieve MT goals.

4.2.5.1 Program Domains and Target Markets

The first of the recommended program planning, design, and implementation steps described in Section 3.1 is to identify target markets (3.1.1). For each program, NMR reviewed program reports to determine whether the program domain (the categories of market actors being leveraged by the program to affect the market) or the target market (the entire supply chain for the products and services in question)⁷⁴ had been identified.⁷⁵ The program domain was identified for all 14 programs (though none used the term *program domain*, and in six cases the domain was not specifically called out, but could easily be determined from the text). Target markets were identified in at least one report for all the programs, though these were seldom clearly marked as the target markets and often had to be gleaned from careful reading of program descriptions.

Table 4-2 shows the market actors identified in the program domains and target markets for each program. That end-users are so frequently part of the program domain reflects the high rate at which these programs attempt to transform markets through activities targeted all up and down the supply chain, as discussed in more detail in Section 4.3.1. In keeping with the market-based focus of MT, the market actors identified in the target markets for these programs appear to be reasonably representative of the respective supply chains.

⁷⁴ Rosenberg and Hoefgen, “Market Effects and Market Transformation.”

⁷⁵ Programs qualified as having the program domain identified if a reasonably clear description appeared in at least one program report.

Table 4-2: Identification of Program Domain and Target Markets in Program Reports

	Program Type & Administrator													
	Lighting			Products				Whole House		New Construction			HVAC	
	Efficiency VT	MA Program Administrators	NEEA	Efficiency VT (Appliances)	NYSERDA	NEEA (TV)	NEEA (Clothes Washers)	Efficiency VT	NYSERDA	Efficiency VT	NYSERDA	NEEA	NYSERDA	NEEA (DHP)
Program Domain														
Upstream														
Manufacturers	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
Manufacturer Representatives													✓	
Midstream														
Distributors	✓		✓	✓	✓	✓	✓					✓	✓	✓
Contractors								✓	✓	✓	✓	✓	✓	✓
Builders										✓	✓	✓	✓	
Retailers	✓	✓	✓	✓	✓	✓	✓							✓
Auditors/Energy Raters				✓				✓	✓	✓	✓	✓		
Downstream														
End-users	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other														
Utilities	✓		✓				✓	✓				✓		✓
Architects, designers			✓											
Engineers			✓											
EPA/ENERGY STAR	✓		✓			✓	✓							✓
Trade Associations								✓						
Appraisers												✓		
Verifiers												✓		
Realtors												✓	✓	
Municipalities/State Offices												✓		
Target Markets														
Upstream														
Manufacturers	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
Manufacturer Representatives													✓	
Midstream														
Distributors	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Contractors								✓	✓	✓	✓	✓	✓	✓
Builders									✓	✓	✓	✓	✓	
Remodelers									✓	✓				
Retailers	✓	✓	✓	✓	✓	✓	✓		✓					✓
Auditors/Energy Raters								✓		✓	✓			
Suppliers						✓			✓		✓			
Downstream														
End-users	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other														
Utilities	✓		✓				✓	✓	✓			✓		✓
Architects, designers			✓											
Engineers		✓	✓											
EPA/ENERGY STAR	✓		✓		✓	✓	✓							✓
Trade Associations								✓						
Lenders									✓					
Appraisers									✓			✓		
Verifiers												✓		
Realtors												✓	✓	
Municipalities, State Offices									✓		✓	✓		

4.2.5.2 Market Models, Program Theories, Logic Models, and MT Stories

Table 4-3 shows information about the use of program theory and logic models, market models, and their linkages across the 14 programs.

Developing a graphic model of how the market is supposed to work is among the good MT practices identified from the literature (described in Section 3.1.4). As Table 4-3 shows, while NMR found written descriptions of how the market is supposed to work for 7 of the 14 programs, none depicted the market model in graphic form. A written description without a graphic model may well be sufficient if the practitioner is careful to address all the key elements, but a picture may make it easier for program planners to think about how best to engage the market.

Other effective practices identified in the literature are to develop a program theory and logic model, match these to the market characterization or market model, and develop a market transformation story (Sections 3.1.5 and 3.1.6). NMR found either a logic model flowchart, logic model table or a narrative of the program theory for all but two of the 14 programs. One of the programs lacking this information, NEEA Clothes Washers, was among the earliest MT programs. The primary formative research for this program was conducted under EPRI project management and is proprietary.

All the logic models or program theories of the twelve programs that were found to have these clearly show how the program is supposed to affect the market by linking program activities with anticipated outcomes. That said, not all logic models or program theories distinguish clearly between program outputs (i.e., the activities performed by the program) and outcomes (i.e., what is expected to result from the program activities). One logic model and the template which Efficiency Vermont uses to articulate program theory (described in Appendix A) does not clearly differentiate between these two elements. Of the seven programs with logic model flowcharts or tables that differentiated outcomes, all organized the outcomes by chronology, from short-term to long-term. All eight programs for which logic model flowcharts or tables were available had market progress indicators that were clearly linked with the logic model. This suggests that at least the three program administrators with logic models available have developed market transformation stories articulating linkages between program efforts and the future state of the market (Section 3.1.6).

Of the seven programs that have both program theories/models and market models/descriptions of the market, all explicitly or implicitly describe how they are linked.

Table 4-3: Use of and Linkages between Logics Models/Program Theory and Market Models

		Have a market model (M) or description (D) of how market works	Have a logic model flowchart (F), table (T) or narrative (N) of program theory	Market model/description is clearly linked to program logic model/PT	Program theory, logic model, or program model clearly shows how the program is supposed to affect the market (links between activities & outcomes)	Outputs appropriately differentiated from outcomes	Outcomes are organized by time frame (short-term to long-term)	Program theory, logic model, or program model is linked with market progress indicators
Lighting	Efficiency VT	D	N	✓	✓	**	***	**
	MA Program Administrators	--	T	Not applicable	✓	--	--	✓
	NEEA	*	F	Not applicable	✓	✓	✓	✓
Products	Efficiency VT (Appliances)	D	N	✓	✓	**	***	**
	NYSERDA	D	F	✓	✓	✓	✓	✓
	NEEA (TV)	D	F	✓	✓	✓	✓	✓
	NEEA (Clothes Washers)	--	--	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Whole House	Efficiency VT	D	N	✓	✓	**	***	**
	NYSERDA	D	F	✓	✓	✓	✓	✓
New Construction	Efficiency VT	D	N	✓	✓	**	***	**
	NYSERDA	--	F	Not applicable	✓	✓	✓	✓
	NEEA	--	F	Not applicable	✓	✓	✓	✓
HVAC	NYSERDA	--	--	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	NEEA (DHP)	--	F, N	Not applicable	✓	✓	✓	✓

* The research team did not find a market description or model for this program, but since the program was established in the 1990s and little information is available online from this period, not finding one does not mean that one does not exist.

** Only the template for Efficiency Vermont's "Market/Initiative Brief" was available for review. Efficiency Vermont uses the "Market/Initiative Brief" in lieu of market models or logic models. Outputs and Outcomes are not differentiated in this template.

*** Efficiency Vermont's "Market/Initiative Brief" template includes intermediate-term performance goals as well as long-term visions for the market and the initiative, but does not include outcomes organized by timeframe.

4.2.5.3 Frequency of Market Research Studies

NMR categorized the publicly available reports by whether or not part or all of the report qualified as a study of market characterization, market assessment, market segmentation, or other market research and used this information to develop a rough estimate of the frequency with which market research had been performed for the programs. We believe these estimates are low, as in some cases we know we were not able to obtain all the studies conducted for each program and in others we suspect we are missing some studies. It was possible to calculate the length of time between studies with market research content from program inception to 2013 (or to end of the program) for 11 of the programs. For these programs, the median length of time was two years. The minimum (as well as the mode) was 0.4 years, and the maximum was 6.5 years.

These findings provide evidence that the program administrators whose programs are examined here are implementing both the practices of characterizing the market (3.1.2) and performing regular, ongoing research into the status of the market (3.2.3).

4.3 Common MT Program Strategies

NYSERDA and NEEA staff both described the strategies typical of their organizations' MT programs or initiatives.

A NYSERDA interviewee described the strategies by which the NY ENERGY STAR Certified Homes Program (NYESCH) aims to reduce energy consumption of new homes, noting that these are common among NYSERDA MT programs. These include:

- Program “participants” include upstream market actors, such as builders, HVAC technicians, Home Energy Rating System (HERS) providers, and HERS raters. Participants must sign a participation agreement with NYSERDA.
- Technical assistance is offered to these upstream market actors. Incentives are offered to some as well.
- Affiliation with the program requires that participating builders construct homes to program standards.
- The NYESCH Program has robust builder and consumer-based mass media marketing campaigns. The program also offers a co-operative advertising incentive to builders, HERS Providers, and Home Energy Raters for qualified advertising.

According to NEEA interviewees, the strategies typical of NEEA MT initiatives include:

- Involving stakeholders in the initiative. This includes but is not limited to working with local utilities that will help amplify the regional MT initiative.
- Marketing, typically to build consumer awareness and encourage consumer adoption of the product or service.
- Training and education, often of market actors to introduce them to new technologies and how to use or install them.
- Addressing higher incremental costs of efficient technologies or services through midstream or upstream rebates, or by leveraging incentives offered by utilities.
- Partnering with market actors, such as manufacturers, to enhance or change their product offerings or services. This often includes working with partners to create a business case for a product or service or to showcase the value of it.
- Working with the federal government or the states in NEEA's region on advancing codes and standards in order to lock in the savings that they are working to achieve.

According to one NEEA interviewee, direct strategies typically associated with resource acquisition can be part of NEEA market transformation initiatives, but cannot be the *only* strategies of these initiatives. The program timeframe is an important differentiator of MT programs. For example, the NEEA DHP initiative “primed the pump” for Ductless Heat Pumps in the Pacific Northwest for four years before local utilities could begin to offer downstream incentives to encourage adoption of this product by its customers. During this time, the Ductless Heat Pump initiative focused on activities such as training an installer base, bringing manufacturer technical training to the region, and aligning product specifications. Only when the

initiative had addressed market barriers such as product quality, lack of trained contractors, poor quality installation, high cost, and the need for a business case for more manufacturers to produce the product did the utilities begin to approach consumers about Ductless Heat Pumps and offer incentives for this product.

4.3.1 MT Program Strategy Insights from Program Reviews

For each program, NMR attempted to categorize the strategies and market actors targeted based on the program reports. The strategies and target actors were difficult to categorize accurately from the reports in the amount of time available given the study scope and budget, as the details were often not described and the exact ways in which the strategies are actually applied varied considerably. Table B-1 through Table B-5 in Appendix B show our categorization of the strategies, which is summarized in Table 4-4 below. Together, the tables offer evidence that these programs routinely include strategies targeted at both the supply and demand sides, as several practices under the header “working with markets” (3.1.10.1) suggest, including recognizing and using market forces, finding market allies who are willing to work with the program, and using upstream market actors to influence downstream adoption of energy-efficient products and services. When incentives are used, they are most commonly offered upstream, as buydowns to manufacturers or markdowns to retailers, or midstream to builders or contractors. The activity most commonly targeted to end-users is advertising. A few of the programs do offer incentives to end-users, but not as major strategies and always in conjunction with other efforts up and down the supply chain.

Table 4-4: Most Common Program Strategies by Program Type

Lighting	Products
<ul style="list-style-type: none"> • Engaging retailers with markdowns and various kinds of marketing support • Engaging manufacturers with buydowns and in specification development • Engaging distributors in specification development and with technology information • Engaging consumers with advertising, awareness building, and education 	<ul style="list-style-type: none"> • Focusing on retailers, including retailer incentives (markdowns, spiffs, etc.), field support, and sales staff training • Coordinating with industry on specifications • Offering ENERGY STAR and cooperative advertising efforts focused on consumers
New Construction	Whole House
<ul style="list-style-type: none"> • Subsidizing energy ratings through builders • Training builders, verifiers, real estate professionals, and other market actors • Providing installation quality assurance • Marketing to end-users • Provide equipment rebates to end-users 	<ul style="list-style-type: none"> • Training contractors • Providing marketing support for or cooperative advertising with contractors • Engaging end-users either through financing, low-cost audits, and advertising or through installation incentives
HVAC	
<p>Both NEEA’s and NYSERDA’s programs recruit, engage, and develop partnerships with market actors, but otherwise there is little overlap in the strategies of these programs.</p> <ul style="list-style-type: none"> • In its Ductless Heat Pump program, NEEA focuses on working with upstream industry on spec development, midstream with retailers on in-store marketing and with contractors on installation support, and downstream by targeting end-users with mass advertising, in-store marketing, and installation quality assurance. • In its Upstream HVAC program, NYSERDA focuses on buydowns with manufacturers and distributors, cooperative marketing, and reaching out to the supply chain to help increase the supply of energy-efficient products. 	

As the tables show, compared to other program administrators, NEEA more often lists developing specifications and standards among its strategies.

While some of the programs include incentives—and, in some cases, rebates—among their strategies, as described above, a handful link to, leverage, or rely on *other* programs using primarily a resource acquisition approach, a practice described in Section 3.1.10.3. As Table 4-5 shows, three NEEA initiatives and one Efficiency Vermont program clearly linked to or leveraged such programs.

Table 4-5: Leveraging of Resource Acquisition Programs by MT Programs

Program Type	Program Administrator	Links to, Leverages, or Relies on a RA Effort	
Lighting	Efficiency VT		
	MA Program Administrators		
	NEEA	✓	Leverages local utility support for retail program efforts
Products	Efficiency VT (Appliances)		
	NYSERDA		
	NEEA (TV)		
	NEEA (Clothes Washers)	✓	Leverages local utility support for clothes washer program efforts
Whole House	Efficiency VT	✓	Leverages local utility program efforts, such as sharing costs of incentives
	NYSERDA		
New Construction	Efficiency VT		
	NYSERDA		
	NEEA		
HVAC	NYSERDA		
	NEEA (DHP)	✓	Umbrella initiative that relies on incentives from the individual utilities to homeowners

4.4 Perspectives on Program Success and Progress Toward MT

For the eight programs, interviewees were asked for their perspective on the success of the program and the progress made toward market transformation with the program.

4.4.1 Efficiency Vermont

Efficiency Vermont staff consider all the programs reviewed for this study to be successful in transforming the market. Staff noted that the Residential New Construction program in particular has made substantial progress toward market transformation, as evidenced by the drop in average HERS index for new homes (60 in 2008 to 51 in 2013) and a 9% increase in efficiency in five years.

4.4.2 Massachusetts Program Administrators

The three Massachusetts interviewees who were asked about program success all noted that, while the residential lighting program has made progress toward transforming the market in Massachusetts over the last decade and a half, work remains. From the perspective of one interviewee, the program had substantial effects on the Massachusetts lighting market in the mid-2000s, but since then the rest of the country has caught up. In this interviewee's opinion, there is qualitative evidence that, while the Massachusetts program has played a role in bringing the rest of the nation's lighting market to where it is today, no one has tried to make a case for this, and the size of the program's impact on the national market is an unresolvable question.

4.4.3 NYSERDA

According to the NYSERDA interviewees, the relationship between the program and the NYS Department of State, Division of Code Enforcement and Administration, provides good evidence that the NYESCH Program has made progress in transforming the residential new construction market in the NYSERDA service area. The program has served as a resource to Department of State staff in incorporating more stringent requirements into the NYS Energy Conservation Construction Code. As the state code has advanced, NYSERDA has made the requirements for homes to qualify for the New York ENERGY STAR Certified Homes program more stringent in order to keep ahead of the code that the program has been helping to advance.

According to NYSERDA staff, the NYSERDA Home Performance program made better progress toward transforming the home retrofit market early in its life than it has in recent years. The proportion of eligible homes that have undertaken a whole-house assessment and related energy savings measures is still low. Program participation suffered starting in 2010 with the launch of the Energy Efficiency Portfolio Standard, which enabled utilities operating in the NYSERDA service area to offer rebates directly to homeowners for specific measures. These rebates are larger than the incentives NYSERDA is able to offer in conjunction with this whole-house MT program and are easier for homeowners to obtain than a whole-house performance assessment and related quality control services via the NYSERDA program.

4.4.4 NEEA

For two of the three initiatives about which NEEA staff were interviewed, Resource-efficient Clothes Washers and the TV initiative, NEEA has already declared the markets transformed and has ended the initiatives. NMR asked a NEEA staff interviewee to assess the success of the remaining initiative, Ductless Heat Pumps, in transforming the market. This interviewee offered much evidence that the Ductless Heat Pump initiative has had an effect on the market for this product. For example, NEEA's and the region's utilities' work has increased consumer awareness of the product from 5% to 30%, and because NEEA has brought technical training to the region, contractors and installers know how to properly install this equipment. In addition, NEEA worked with Sears and Home Depot to bring display units and ductless heat pumps to retail stores for the first time. The interviewee noted that manufacturers are starting to adopt the way in which NEEA markets and communicates about ductless heat pump technology, and NEEA's local utility partners are beginning to leverage its efforts by offering incentives for DHPs.

4.5 Evaluation

Interviewees were asked about their organizations' approaches to market progress tracking and market effects evaluation, the use of formal protocols for evaluating MT programs, policies specific to MT program evaluation, and claiming savings from market effects. NMR also reviewed program reports to glean market progress indicators measured or proposed for each program and assess attribution approaches across the programs. As the indicators found were too numerous to list them in this study, NMR is providing these to the California utilities under separate cover. Section 4.5.5 summarizes findings from the review of market progress indicators. Section 4.5.6 summarizes findings from the review of attribution approaches.

4.5.1 Efficiency Vermont

As noted above, the Vermont Public Service Department is responsible for the evaluation of Efficiency Vermont's energy-efficiency programs. Public Service Department staff were not interviewed for this study. Efficiency Vermont itself assesses cost-effectiveness for its programs at the portfolio level using the TRC test, which accounts for more than just energy savings.

4.5.1.1 Market Effects Evaluation Approach

Since the Vermont Public Service Department is responsible for program evaluation, Efficiency Vermont interviewees could say little about planning for the evaluation of market effects of its programs. One interviewee offered the opinion that Efficiency Vermont could be more systematic about identifying indicators to show progress toward market transformation in the residential sector. (This interviewee noted that Efficiency Vermont currently focuses primarily on the number of projects completed or savings acquired, rather than on other kinds of market-based progress indicators.)

4.5.1.2 Market Progress Tracking

According to one Efficiency Vermont interviewee, a key market progress indicator for the Residential New Construction program is a quantifiable performance indicator, or QPI, that Efficiency Vermont is required to report to the Public Service Department as part of its appointment. The interviewee believes the rationale behind this indicator is to show progress toward the state's goal of all new homes achieving net zero energy use by 2030. Another market progress indicator, the average HERS index of all new homes in the state, is a good metric of overall efficiency of new homes over time. It has the advantage of being a standardized measurement that is comparable across states. A number of other indicators are tracked in the Vermont Public Service Department's tri-annual new construction market characterization/baseline study. While these are not described as market progress indicators in the study in which they are reported, this is what the interviewee considers them to be.

4.5.1.3 Evaluation Policies and Protocols

It was the understanding of Efficiency Vermont staff interviewed for this study, and of NMR staff who work on evaluation for the Public Service Department, that the Public Service neither has nor follows evaluation protocols specific to MT programs.

4.5.1.4 Claiming Savings from Market Effects

One interviewee explained that the Residential New Construction program claims savings on the difference between the baseline features of non-program homes in the state, which in some cases are lower than average, and the energy savings from bringing program homes up to code in addition to the energy savings from taking them beyond code.

4.5.2 Massachusetts Program Administrators

4.5.2.1 Market Effects Evaluation Approach

One interviewee who has been involved with the lighting program since its inception noted that, by design, evaluators have taken the same basic market assessment-focused evaluation approach to evaluating the program for approximately the last decade. This includes regular saturation and hours-of-use studies, consumer surveys, shelf stocking and pricing studies, and upstream interviews. The studies are performed frequently (every three or four years for hours-of-use, which support gross savings estimates, and annually for consumer surveys, saturation surveys, and upstream interviews). The market assessment-focused evaluation approach as well as the frequency with which the studies are conducted are suitable for the lighting program for three reasons: 1) It seemed to the interviewee and others that the program had the potential for substantial, long-term market effects, and these could only be understood by studying the market. 2) The lighting market was changing rapidly and unpredictably. 3) Residential lighting was a very important source of savings in the overall portfolio. Net-to-gross (NTG) analyses are also performed every one to three years. The frequency of these NTG analyses reduces risk to the program administrators, who are faced with demanding annual savings goals and the possibility of lost revenue due to evaluation results. This interviewee noted that the evaluation approach is driven by the magnitude of perceived savings, the perceived likelihood of market effects, and the speed of change in the market, *not* by its original status as an MT program. According to this interviewee, other Massachusetts programs typically spend far less on regular market assessment than has historically been spent for residential lighting.

As Hoefgen et al. explain in a paper reviewing evaluation results for this program, frequent calculation of NTG by this program results in the evaluations capturing some market effects. Viewed collectively, the multiple years' NTG ratios show an acceleration of the adoption curve, a market effect that is an aim of diffusion theory-based MT programs.⁷⁶ In a related comment, another interviewee noted that the annual tracking of key indicators has allowed the program administrators to understand the changes in the market better than if the indicators had been evaluated less frequently. As this interviewee explained, NTG went from 1.15 in 2005 to 2.77 in 2006 and 2.15 in 2007, then dropped to precipitously to 0.41 in 2008 and 0.47 in 2009-2010. Had NTG been examined just once, retrospectively, for the 2006-2008 program period, as was the case in California, the high NTG values of 2006 and 2007 would have been missed.

Several interviewees pointed out that after 2007, the program increasingly focused on near-term savings in response to ambitious state energy-efficiency goals—to the point that eventually it could no longer be considered to qualify as a strategic market transformation program. When asked whether and how the evaluation approach changed after 2007, one interviewee noted that since then, there has been somewhat more focus on net-to-gross, with a particularly ambitious net-to-gross study performed in 2010-2011 using five different methods to address concerns

⁷⁶ Hoefgen, L., A. Li, G. Azulay, R. Pahl, and S. Oman, "Market Effects: Claim Them Now or Forever Hold Your Peace" (proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings, 2008).

about very large savings claims.⁷⁷ However, the evaluations performed since 2007 have continued to draw on the same kinds of market assessment data collected since the program's beginning.

According to another interviewee familiar with the evaluation of Massachusetts residential programs, the evaluation consultants to the Energy Efficiency Advisory Council (EEAC) work with the evaluation staffs of the Program Administrators and the evaluation contractors to plan evaluations for the residential lighting program, as they do with all their residential programs. Historically, the residential lighting program receives considerable attention because it is responsible for a large proportion of portfolio savings. Ralph Prah, an EEAC evaluation consultant, is a primary architect of the market transformation and market effects concepts and has had considerable influence on the frequency and approach of evaluation for this program. While the evaluation staffs of the Massachusetts Program Administrators have been actively involved in planning for the lighting program evaluation over the years, Massachusetts program administrator implementation staff have not. The EEAC is advocating much more communication between implementers and evaluators in the future.

4.5.2.2 Market Progress Tracking

The review of market progress indicators showed that the Massachusetts Program Administrators have tracked a wide variety of market progress indicators for the lighting program, many on a roughly annual basis, for over a decade. Three interviewees noted that the choice of progress indicators for the program was achieved through discussion and negotiation among the program administrators, EEAC consultants, and evaluation team, guided by the program theory. One interviewee who had long been involved with the evaluation of the program noted that a selection factor for indicators was that they should be trackable on a regular basis for a long period of time. As the market has changed, some of the indicators have changed. For example, in the mid-2000s, socket saturation became an important indicator as the CFL market matured to the point that a higher-level, slower changing progress indicator was needed. Another interviewee noted that, over time, some indicators have been dropped due to practical reasons, such as limited budgets, survey length, or to make room for higher-priority new indicators.

4.5.2.3 Evaluation Policies and Protocols

Interviewees for the Massachusetts lighting program were not aware of any Massachusetts evaluation protocols specific to MT programs. One interviewee noted that, in general, the methods used for Massachusetts program evaluation tend to shift with changing needs and concerns of the program administrators, the ever-changing markets, and innovations in evaluation approaches. While Massachusetts has standardized approaches to estimating gross savings, evaluated gross savings, and net energy and demand savings and has mandated

⁷⁷ NMR Group, Inc., KEMA, Cadmus Group, and TetraTech, "Massachusetts ENERGY STAR Lighting Program: 2010 Annual Report, Volume 1." (June 13, 2011), accessed October 23, 2013, http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2011/2011%20Residential%20Studies/MA%20Res%20Lighting%202010%20Overall%20Rpt%20Vol%201.pdf.

precision levels depending on the purpose of the measure, the manuals that lay out these approaches are not prescriptive in the manner of some other states' protocols.

In the opinion of this interviewee, who was very familiar with the evaluation of this and other Massachusetts residential programs, Massachusetts regulators, EEAC consultants, and program administrators prefer that evaluators demonstrate attribution for programs. This is often done at the market level for MT programs, especially when end users of the product or service are not aware of the program support.

4.5.2.4 **Claiming Savings from Market Effects**

A review of the Massachusetts residential lighting program evaluation reports showed that savings for this program have historically been measured at the market level (within the targeted market only), and effects of the program on the markets in other states—which have frequently been used to calculate baselines—are not considered. All the interviewees who were asked whether the Massachusetts Program Administrators claim savings from market effects explained that they were able to do so only to the extent that the market effects are embedded in the NTG ratios, and added that this is true for other programs, not just residential lighting. There is no explicit adjustment for any other market effects.

4.5.3 NYSERDA

4.5.3.1 Market Effects Evaluation Approach

Based on NMR's review of NYSERDA reports for the programs included in the study, it appears that NYSERDA routinely develops logic models for its programs and updates these periodically. NYSERDA logic models typically appear in standalone reports that include proposed market progress indicators organized by outcome.

According to the staff interviewed, NYSERDA measures market effects and calculates NTG, but not Non-Energy Impacts (NEIs), for the ENERGY STAR Certified Homes program.

4.5.3.2 Market Progress Tracking

According to one NYSERDA interviewee, the program logic models inform the programs' evaluation plans and research objectives. Each research objective in the logic model is tied to an indicator. In a review of the NYSERDA program documents, NMR found that, for these programs, NYSERDA updated market progress indicators periodically in conjunction with its update of the program logic models. In each case, NYSERDA market progress indicators are clearly linked with expected program outcomes (Table 4-3), which are organized by the timeframe in which they are expected to occur (short-, intermediate-, and long-term).

4.5.3.3 Evaluation Policies and Protocols

In 2012, the New York State (NYS) Department of Public Service and the Evaluation Advisory Group released evaluation guidelines that include an appendix devoted to the evaluation of spillover by NYS program administrators.⁷⁸ As Figure 3-5 illustrates, when measured at the market level, market effects are considered part of spillover. According to a NYSERDA interviewee, NYSERDA is developing guidelines that will be specific to the evaluation of the subset of spillover represented by market effects. The 2012 NYS guidelines also include some very general guidance on spillover attribution measurement.

Spillover is defined in the 2012 guidelines as “the energy savings associated with energy-efficient equipment installed by consumers who were influenced by an energy-efficiency program, but without direct financial or technical assistance from the program. Spillover includes additional actions taken by a program participant as well as actions undertaken by non-participants who have been influenced by the program.” According to these guidelines, “Because causality is inherent in the very definition of spillover, the spillover savings are inherently net.” Spillover is included along with free-ridership in NYSERDA NTG ratios to reflect the degree of program-induced actions,⁷⁹ since without spillover the NTG ratio would be biased downward. The guidelines give guidance about questions to consider when determining how to measure

⁷⁸ “New York Evaluation Plan Guidance for EEPS Program Administrators,” last updated November 2012, accessed September 12, 2013, [http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/766a83dce56eca35852576da006d79a7/\\$FILE/EVALGUIDE.11.12.pdf](http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/766a83dce56eca35852576da006d79a7/$FILE/EVALGUIDE.11.12.pdf).

⁷⁹ In “Evaluation Plan Guidance for EEPS Program Administrators,” (Ibid.), NYSERDA defines the NTG ratio as “(1-Free ridership) + Spillover.” The quotes in this paragraph are from pages 43 and 44.

spillover depending on where in the market (upstream, midstream, or downstream) the spillover is theorized to occur. Table 4-6 below shows the recommended approaches for measuring upstream spillover and attribution (i.e., causality) from the guidelines.

Table 4-6: Standard and Enhanced Spillover Measurement Approaches for NYSERDA Programs by Theorized Location of Spillover

Location of Spillover	Standard Rigor	Enhanced Rigor
Estimation of gross savings from upstream actors (participants and/or nonparticipants).	Self-reports generally sufficient.	Researchers must attempt to confirm self-reports using methods such as changes in sales, stocking or shipment data, review of planned or completed project or permits, or on-sites.
Estimation of program influence for upstream actors (participants and/or nonparticipants).	Basic self-reports generally sufficient.	Either additional methods such as quasi-experimental design, econometric analysis, or Delphi panels should be deployed or a case should be made that such methods are either not viable or not cost-effective.
Documentation of causal mechanisms.	Recommended but not required.	Required, using methods such as self-reports from end-users or market actors regarding the manner in which the program influenced their behavior, and/or theory-driven evaluation practices.

Source: Evaluation Plan Guidance for EEPS Program Administrators.⁸⁰

The guidelines note that NYS efficiency program administrators should propose methods to avoid double counting participant and nonparticipant spillover. If it is not possible to estimate nonparticipant spillover reliably at the program level due to multiple program interventions in the same market involving multiple market actors, then market effects studies can be done for specific measures and markets. If the expense of measuring spillover reliably is prohibitive, the program administrator “may negotiate a deemed spillover rate based on a review of the literature and the program theory and logic model that together describe reasonably well the causal mechanism that is expected to generate spillover.”⁸¹

4.5.3.4 Claiming Savings from Market Effects

Three NYSERDA programs reviewed for this research had reports available in which attribution was measured. In all three cases, market effects were included implicitly in NTG, which was measured at the program level. According to NYSERDA staff, inclusion in NTG measurement is currently the only way that the programs are able to claim savings from market effects. (For more information, see Section 4.5.6.)

⁸⁰ Ibid.

⁸¹ Ibid., 48.

4.5.4 NEEA

4.5.4.1 Market Effects Evaluation Approach

As part of the process of vetting proposed initiatives for its portfolio, NEEA prepares evaluation plans for testing the market effects of each initiative. To this end, NEEA evaluation staff members are part of cross-functional program teams from the initiative planning stage onwards. Evaluation staff creates logic models and ensures that the market progress indicators identified can indeed be evaluated. Because of the close involvement of the evaluation staff, program staff need not wait for formal reports to obtain evaluation insights that may warrant changes to the program.

The approach taken to evaluating market effects for a given initiative depends on the market progress indicators that are being measured, which vary from initiative to initiative.

For each initiative, NEEA develops an Alliance Cost Effectiveness, or ACE, model to support cost-effectiveness measurement and tracking, as well as reporting of energy savings from market effects and allocation of savings to funders. ACE is a mathematical representation of the logic model that models the market, the initiative, and what NEEA expects to happen over time. NEEA uses rigorous technical assumptions in the models and works closely with the Northwest Regional Technical Forum on these assumptions. ACE models are one of the reasons that NEEA undertakes large building stock characteristic assessments. The models forecast the savings stream and produce the cost-effectiveness metrics for each initiative. On an annual basis, a third party evaluates key assumptions that drive the ACE model outputs of each initiative. When NEEA obtains sales and evaluation data, they incorporate these data into the models, produce annual savings estimates, and vet the estimates with an advisory committee. NEEA reports the results for the entire region to NEEA's Board and to each individual funder for that funder's service area.

The review of documents provided evidence that NEEA has refined these programs' logic models as the programs have changed over time.

4.5.4.2 Market Progress Tracking

In a review of the NEEA program documents, NMR found market progress indicators for all the programs reviewed. As Table 4-3 shows, these are clearly linked with expected program outcomes. The outcomes are organized by the timeframe in which they are expected to occur (i.e., short-, intermediate-, and long-term).

4.5.4.3 Evaluation Policies and Protocols

NEEA uses evaluation best practices resources from respected evaluation organizations such as the Kellogg Foundation (which provides guidance on best practices for logic models) and the American Evaluation Association.⁸² Based on the descriptions offered by NEEA interviewees,

⁸² The Northwest Regional Technical Forum provides sources of data and research for program evaluation in the region, but does not promulgate general evaluation methodologies.

NEEA appears to have developed systematic approaches that result in a fair degree of consistency in evaluation across its initiatives. For example, as part of program planning, NEEA develops a description of the anticipated life cycle for each initiative, from birth to transformed market. The description includes evaluation deliverables at each phase of the initiative, from market characterization to measuring baseline to Market Progress Evaluation Reports (MPERs) to long-term monitoring and tracking of market progress.

For those market effects not tied to a specific utility program, NEEA measures initiative “influence” and claims the savings on behalf of its funders. NEEA avoids double-counting where there are both local programs and its regional MT initiatives in the market by allocating *all* savings that can be tied to a specific utility program to that program. For example, when NEEA began the ENERGY STAR Northwest Homes initiative, ENERGY STAR was below code in a few of the states in the NEEA region. NEEA negotiated a Northwest ENERGY STAR specification on behalf of the region, built the market capability through the trades to meet the specification in new homes, and worked with utility partners who wanted to offer their own local residential new construction programs with incentives. Now, when NEEA assesses market adoption of ENERGY STAR Northwest Homes, all the savings from ENERGY STAR homes that obtained rebates from a utility are claimed by the utility as direct savings. Only those savings from homes that achieved the ENERGY STAR specifications without a utility-provided incentive are identified as a market effect from the NEEA initiative. This portion of the savings is then allocated across all NEEA funders. The utilities could not have had an ENERGY STAR Homes program without NEEA, but NEEA does not attempt to tease out initiative attribution for any of the savings currently assigned to the utilities.

4.5.4.4 Claiming Savings from Market Effects

According to NEEA interviewees, it is NEEA’s understanding that each NEEA funder is able to claim the energy savings from the net market effects of NEEA initiatives.

4.5.5 Use of Market Progress Indicators

NMR found market progress indicators listed in reports for 13 of the 14 programs. (The exception was NYSERDA Upstream HVAC, for which only process evaluations were available. We would not expect to find market progress indicators listed in process evaluations.) We identified 325 market progress indicators across the 13 programs. However, within each program type, many of the indicators are minor variations on the same few themes, so the total number of truly unique indicators is much smaller than this. Some of the indicators are proposed and may not have been operationalized as a measurement. The budget did not allow for a distillation of the indicators to a small number of common items. Under separate cover, NMR has provided a spreadsheet of indicators by program type to the IOUs for their further analysis. This spreadsheet includes the availability of related data collection instruments.

As Table 4-7 shows, the market progress indicators encompass a wide range of types. The most common indicator types are market actor or supply chain adoption or acceptance (15%) and ultimate indicators of market share or sales (14%). The observations from in-depth interviews as well as the review of program reports provide evidence that the three program administrators with logic models available are tracking indicators tied to expected outcomes, the practice described in Section 3.2.2. For example, Table 4-3 shows the logic models of the three program administrators with outcomes organized by timeframe and clearly linked with market progress indicators, and Table 4-7 shows that nearly three-quarters of the individual indicators that NMR identified are explicitly linked to the program theory or logic model.

Table 4-7: Characteristics of Market Progress Indicators

Market Progress Indicator Characteristics	PROGRAM TYPE					Total
	Lighting	Products	Whole House	New Construction	HVAC	
Number of Programs Reviewed	3	4	2	3	2	14
Number of Documents Reviewed	15	19	7	14	3	58
Total Number of Indicators Measured	70	44	57	136	18	325
Type of Indicator						
Market actor / Supply chain awareness / acceptance / adoption	0% (0)	2% (1)	23% (13)	26% (35)	0% (0)	15% (49)
Market share / sales	23% (16)	18% (8)	21% (12)	7% (9)	0% (0)	14% (45)
Customer acceptance / adoption / demand	17% (12)	9% (4)	11% (6)	11% (15)	28% (5)	13% (42)
Customer awareness / knowledge	14% (10)	7% (3)	11% (6)	10% (14)	11% (2)	11% (35)
Product / service availability	11% (8)	20% (9)	5% (3)	5% (7)	11% (2)	9% (29)
Changes to industry structure or practices	0% (0)	0% (0)	4% (2)	17% (23)	28% (5)	9% (30)
Program contractor / partner / vendor acceptance / adoption / engagement	6% (4)	23% (10)	11% (6)	4% (6)	0% (0)	8% (26)
Saturation / penetration	14% (10)	2% (1)	0% (0)	1% (2)	0% (0)	4% (13)
Product / service quality	4% (3)	0% (0)	2% (1)	4% (6)	0% (0)	3% (10)
Incremental cost	6% (4)	5% (2)	0% (0)	2% (3)	0% (0)	3% (9)
Changes in NEB Indicators (e.g., IAQ, comfort, health, safety, etc.)	0% (0)	0% (0)	5% (3)	4% (6)	0% (0)	3% (9)
Changes to codes and standards	1% (1)	2% (1)	0% (0)	4% (6)	17% (3)	3% (11)
Other	3% (2)	7% (3)	5% (3)	1% (2)	0% (0)	3% (10)
Reduction in energy use/demand	0% (0)	5% (2)	4% (2)	1% (2)	6% (1)	2% (7)
Indicators linked with PT/LM	74% (52)	75% (33)	88% (50)	76% (104)	--	73% (239)
Market Effects hypothesized	97% (68)	59% (26)	88% (50)	28% (38)	--	58% (182)

4.5.6 Measurement of Program Attribution and Net Savings

Table 4-8 shows the attribution approaches used for the programs reviewed. Most programs with more than one study measuring attribution repeated the same basic approach. Where this was not the case, the attribution approaches for other year(s) are indicated with the symbol ∅.

- NMR found program evaluation reports addressing attribution for 12 of the 14 programs. Attribution was assessed as part of the NTG calculation for 6 of these 12 programs. Of the 6 programs for which NTG was measured, 3 supplemented this with an assessment of attribution through market progress indicator tracking.⁸³
- One Efficiency Vermont program assessed attribution through market progress indicator tracking without measuring NTG. One of the programs that measured NTG in a later year, NYSERDA NYESCH, measured attribution through indicator tracking alone in 2008.
- For all five NEEA initiatives, NEEA both tracked indicators and used them to estimate the non-intervention baseline, and thus market-level net savings, as expected from NEEA interviews.
- The NTG and net savings assessments were at the program level⁸⁴ only for 2 of the 12 programs; the rest were at either the market level⁸⁵ or both the program and market level.
- Four of the programs included a quantitative cross-comparison across geographic areas using either self-reported quantitative data and program tracking data or quantitative indicator data. None of the programs relied on qualitative methods of assessing attribution alone. Eight programs supplemented the quantitative assessments with qualitative methods of some kind.
- After 2008, the Massachusetts lighting program used structured expert judgments as part of supplemental qualitative data and cross-comparison data as part of a quantitative analysis modeling several states' lighting markets.⁸⁶

Taken together, the information in Table 4-8 demonstrates that the three program administrators who confirmed that they claim savings from the programs' market effects either for themselves or for their sponsors take different approaches to measuring attribution for the market effects, and that in some cases the specifics of these approaches have varied over time.

⁸³ That is, using the market progress indicators to tell a story that establishes a linkage between the program and changes in structure/functioning of the market.

⁸⁴ That is, spillover was measured as a separate component of NTG.

⁸⁵ That is, spillover was not separated out in the NTG measurement.

⁸⁶ This approach was after the period examined for the program.

Table 4-8: Attribution Assessment Type and Method

Program Area	Program	Attribution Assessment Type			Attribution Assessment Method (Quantitative)				Attribution Assessment Method (Qualitative)			Source
		Program Level NTG	Market Level NTG or NS ⁸⁷	Indicator Tracking	Self-Reporting	Cross-sectional Comparisons		Non-intervention Baseline	Historical Tracing /Theory-based	Structured Expert Judgment		
Lighting	Efficiency VT		NTG		√	√			√			1 2
	MA Program Administrators		NTG	√	√	∅		∅	√	∅		√-3 ∅-4,5,6
	NEEA		NS	√	√			√	√			7
Products	Efficiency VT (Appliances)		NTG	√	√	√			√			2
	NYSERDA	√	NTG	√		√						8
	NEEA (TV)		NS	√	√			√	√			9
	NEEA (Clothes Washers)		NS	√	√	√		√	√			10 11
Whole House	Efficiency VT			√	√				√			12
	NYSERDA	√			√				√			13 14
New Construction	Efficiency VT*											
	NYSERDA	√		∅	√				√			√-15 ∅-16
	NEEA		NS	√				√	√			17
HVAC	NYSERDA*											

⁸⁷ NTG refers to market-level Net-to-Gross; NS refers to market-level net savings.

Program Area	Program	Attribution Assessment Type			Attribution Assessment Method (Quantitative)				Attribution Assessment Method (Qualitative)			Source
		Program Level NTG	Market Level NTG or NS ⁸⁷	Indicator Tracking	Self-Reporting	Cross-sectional Comparisons		Non-intervention Baseline	Historical Tracing /Theory-based	Structured Expert Judgment		
	NEEA (DHP)		NS	√	√			∅	√			√-18 ∅ -19

* NMR did not find a study with attribution assessment for this program.

¹ Nexus Market Research, Inc., “Analysis of CFL Purchases in Vermont Final Report” (June 9, 2009).

² KEMA, Inc., “Final Report: Phase 2 Evaluation Of The Efficiency Vermont Residential Programs” (December 2005).

³ Nexus Market Research, Inc., RLW Analytics, and Dorothy Conant, “Market Progress and Evaluation Report (MPER) For the 2007 Massachusetts ENERGY STAR® Lighting Program” (July 1, 2008).

⁴ NMR Group, Inc., KEMA, Cadmus Group, Inc., and Tetra Tech, “Massachusetts ENERGY STAR® Lighting Program: 2010 Annual Report, Volume 1: Overall Final Report” (June 13, 2011).

⁵ NMR Group, Inc., KEMA, and Cadmus Group, Inc., “Massachusetts ENERGY STAR® Lighting Program 2010 Annual Report, Volume 2: Appendices A-D” (June 15, 2011).

⁶ NMR Group, Inc., KEMA, and Cadmus Group, Inc., “Massachusetts ENERGY STAR® Lighting Program 2010 Annual Report, Volume 2: Appendices E-G” (June 15, 2011).

⁷ KEMA, “ENERGY STAR Consumer Products Lighting Project Market Progress Evaluation Report (MPER 4)” (July 22, 2008, Report #08-195).

⁸ Cadmus Group, Inc., “New York Energy Smart Products Program Market Program Market Characterization and Assessment Evaluation” (February 2012).

⁹ Frank, M., J. Van Clock, A. Dunn, Z. Hathaway, and J. Peters (Research Into Action) and N. de Horatius (University of Chicago), “Consumer Electronics Television Initiative Market Progress Evaluation Report #2” (April 29, 2013).

¹⁰ Pacific Energy Associates, Inc., “ENERGY STAR Resource-Efficient Clothes Washers MPER 5” (June 2001, Report #E01-083).

¹¹ Pacific Energy Associates, Inc., “ENERGY STAR Resource-Efficient Clothes Washers MPER 4” (November 2000, Report #E00-065).

¹² West Hill Energy and Computing, Inc., and GDS Associates, “Efficiency Vermont’s Home Performance with ENERGY STAR Program: Impact Evaluation” (June 3, 2013).

¹³ Megdal and Associates, LLC, “NYSERDA 2007-2008 Home Performance with ENERGY STAR Program Impact Evaluation Report” (September 2012).

¹⁴ Quantec, LLC, and Summit Blue Consulting, LLC, “New York Home Performance with ENERGY STAR Program: Market Characterization, Market Assessment and Causality Evaluation” (May 2006).

¹⁵ Megdal and Associates, LLC, “NYSERDA 2007-2008 New York ENERGY STAR® Homes Program Impact Evaluation Report” (September 2012).

¹⁶ Summit Blue Consulting, LLC, “New York ENERGY STAR Homes Market Characterization and Market Assessment Evaluation (MCA)” (February 2009).

¹⁷ Evergreen Economics, “Northwest ENERGY STAR Homes Program: Eighth Market Progress Evaluation Report” (February 14, 2012, Report #E12-235).

¹⁸ Research Into Action, Inc., Northwest Ductless Heat Pump Pilot Project Market Progress Evaluation Report #2, July 24, 2011, Report #E11-224.

¹⁹ Evergreen Economics, “Northwest Ductless Heat Pump Initiative Market Progress Evaluation Report #2” (October 9, 2012, Report #E12-245).

4.6 Identifying Transformed Markets, and Transition or Exit Strategies

The literature describes another effective practice for MT: articulating a transition or exit strategy for programs when market transformation has progressed to the point at which market intervention, at least in the same form, is no longer necessary (Section 3.1.8). Only one of the program administrators, NEEA, *formally* identified a transition or exit strategy for the initiatives examined. According to one NEEA interviewee, all NEEA initiatives include either a transition strategy, such as shifting support to a more efficient technology—for example, LEDs in place of CFLs—or an exit strategy, such as an orderly removal from the market once codes or standards are in place.

Interviewees for other organizations described informal transition strategies for these administrators' programs. In the case of the Efficiency Vermont Residential New Construction Program, there is an informal transition strategy of adding program tiers as energy codes change, until code and all newly constructed homes are net zero. An interviewee for the Massachusetts ENERGY STAR Lighting Program noted that in Massachusetts, MT is not necessarily a process that ends in exiting the market—the typical dynamic is to change focus to the next, more efficient technology. As this interviewee put it, “Success will probably result in a new cycle.” This interviewee predicted that, even after full implementation of EISA in 2020, there might be opportunities in the residential lighting market. Two other interviewees for this program noted the need to look at changing the technology focus of the program as lighting technology evolves. Another Massachusetts interviewee noted that the term *exit strategy* seems to have fallen out of use generally. Due to time constraints, NYSERDA staff were not asked about transition or exit strategies.

4.6.1 Summary of NEEA Transition or Exit Planning

NEEA sets transition or exit criteria in the planning stage of the initiative. The criteria vary by initiative and depend on what being done looks like from a MT perspective. One NEEA interviewee advised that program administrators wishing to undertake MT be mindful up front of what success will look like, the transition or exit criteria, and how they will transition or exit. These strategies need to be as thoughtful as the intervention strategies. It is important for an organization both to hold on to critical activities or information in case it needs to re-enter the market space and to ensure that the organization's reputation is not tarnished as it transitions or exits.

In general, NEEA exits the market, changes its presence in the market, transitions support for the product or service to other entities—such as industry groups or trade associations—or lets local utilities build on the framework and enhance the market when all the following criteria are met:

- The market barriers are removed;
- No national work is needed to make the product available in the retail space;

- No further regional infrastructure work is needed;
- There is reason to believe that if NEEA were to eliminate initiative support, the product would remain in the market;
- The average saturation or energy efficiency of the product or service in the territory is sufficiently high (e.g., for DHP, 15% of electrically-heated homes in the region must have adopted ductless technology);
- Consumer awareness is sufficiently high;
- The market appears to be capable of sustaining long-term change for the product without the initiative.

For the ongoing Ductless Heat Pump initiative, NEEA expects to rely on the market progress indicators to determine when the market has been sufficiently transformed so that the initiative can end or transition in some way. An interviewee opined that a transformed market for this product would have the following characteristics, at a minimum:

- At least 15% adoption of DHPs in electrically heated homes in the region,
- DHPs are more commonly sold in retail outlets than at present, and
- There are federal efficiency standards for DHPs.

After exiting a market, NEEA typically continues tracking market progress indicators for the product or service on which the initiative focused. The NEEA interviewee who was asked about this did not expect DHPs to be an exception. The interviewee noted that one purpose of this monitoring is to identify any backsliding or emerging opportunities in the service or product market that might warrant re-entering it. According to this interviewee, “It’s never the intention that we stay on in an initiative over an extended period of time. We might stay in a marketplace . . . For instance, new construction and the retail space are strategic markets for us, so we would continue relationships there, but the individual initiatives are definitely set to expire.”

In general, however, the findings from in-depth interviews with the four program administrators indicate that the practice of articulating an exit or transition strategy at the initiative or program planning stage is not widespread.

4.7 Policies and Other Considerations Affecting the Programs

The interviewees described a variety of considerations, including regulatory policy, that affect the programs examined.

4.7.1 Efficiency Vermont

In the experience of one Efficiency Vermont interviewee, most Home Performance programs tend to have trouble with cost-effectiveness screening because, although the non-energy benefits from these programs tend to be substantial, they are not fully counted, and the measures tend to be expensive. This interviewee noted that Vermont has been able to surmount most of the cost-effectiveness problems for this program type due in part to shifts in assumptions in the state cost-effectiveness tool for screening projects, including counting NEBs and assessing cost-effectiveness at the program level instead of the individual project level. These changes have allowed wood-heated homes to pass a cost-effectiveness screening despite the low cost of the wood fuel. It is also due in part to the low rate of use of natural gas as a heating source in Vermont.

Vermont lacks meaningful building code enforcement. This puts builders who build to code at a competitive disadvantage. In the opinion of one interviewee, if the state had more robust code enforcement, participation in the Residential New Construction program would rise as more builders sought assistance in meeting and exceeding code.

4.7.2 Massachusetts Program Administrators

According to one interviewee, the fact that Massachusetts evaluation policies do not take the form of prescriptive protocols facilitates program evaluation, allowing methods to change as programs and markets change. Another interviewee noted that, some years earlier, the DPS had investigated the possibility of requiring programs to track participant (end-user) data for programs taking an upstream approach, and decided against it. This interviewee thought that the decision made it possible for the residential lighting program to continue intervening upstream and sent the message that this is acceptable for other programs as well. As this interviewee put it, “In Massachusetts, the regulators have stayed away from micromanaging programs, lighting in particular.”

In a second interviewee’s opinion, claiming savings from the market effects of Massachusetts programs would be simpler if the state had a clear, consistent market transformation program track and framework. A third interviewee noted that the program administrators are able to claim non-energy benefits such as maintenance, lighting quality, and lifetime. This interviewee suspects that the reason NEBs can be claimed separately while market effects cannot is that there is no easy way to quantify savings from market progress indicators such as consumer awareness and acceptance. The second interviewee was of the opinion that claiming savings from market effects or spillover is particularly challenging in situations where utilities administer energy-efficiency programs, as the short-term need to back up revenue recovery claims does not fit well

with the long-term nature of market transformation. This interviewee noted that there have been no explicit market effects studies for the residential lighting program. To this interviewee's knowledge, the only separate lighting market effects evaluation performed in the state was for high-bay lighting in commercial and industrial facilities, which resulted in the negotiation of an informal increase in the NTG ratio for the associated program.

This same interviewee noted that Massachusetts's informal, collaborative approach to evaluation planning—with evaluation consultants to the Energy Efficiency Advisory Council, program administrators' evaluation staff, and evaluation contractors working together—has benefitted the residential lighting program, although it is not a policy per se. In this interviewee's opinion, these parties recognize the need for a fair and unbiased evaluation and are careful both to ensure the use of market-based methods in studies of NTG and to focus on tracking and understanding the impacts of a program within the context of the market. This interviewee believes that such an approach is the *only* way to address evaluation of a MT-oriented program administered by an investor-owned utility.

A third interviewee noted that it is difficult to operate programs with MT goals while simultaneously addressing ambitious resource acquisition goals, such as the state's pursuit of all cost-effective energy efficiency.

4.7.3 NYSERDA

According to staff interviewed for the Home Performance program, a 2011 regulatory decision requiring the Total Resource Cost test to be administered at the individual measure level (knee wall insulation, attic insulation, etc.) has adversely affected this program. This decision led to new program rules that disrupted the marketplace for home performance services. For example, the new rules made selling home performance services more complicated, and participating contractors had to train their sales staff to this end. Prior to the change, NYSERDA had expected program participation to grow 15% annually over the next two years; since the change, participation growth has been flat. It was one interviewee's opinion that the regulatory decision and resulting new program rules were partially responsible—along with a poor economy and low-cost natural gas—for a “mass migration” of potential participants to competing utility rebate programs. Hoping to counter this trend, NYSERDA has been working on a new Web-based portal to reduce the burden on contractors of implementing the new program rules.

4.7.4 NEEA

One NEEA interviewee noted that the funding time horizons for energy-efficiency program evaluation are often fairly short—frequently two years, and at most five years. This timeframe does not mesh well with the time horizon under which savings accrue from the market effects of MT initiatives, which require substantial up-front investments and may take a decade or more to break even. If programs focused on transforming markets are to be treated like generation or other resources, the protracted timeframe of savings from market transformation should be taken into account in evaluation.

4.8 Lessons Learned

Interviewees from four organizations shared additional lessons learned and advice from their experiences planning, implementing, and evaluating strategic MT programs. These are organized below by topic.

4.8.1 Staff for MT

- It is helpful to hire risk-takers who are willing to seize opportunities and able to sell. To work successfully with MT, you have to be a “bit of a risk-taker able to operate in an ambiguous space.” Markets move fast, and staff working on MT need to be able to identify opportunities and take action in a timely fashion without a great deal of information. MT also requires salesmanship to bring market partners on board, since the idea of MT can be a hard sell. –*NEEA*

4.8.2 Changing Markets

- MT interventions can dramatically change markets over time, even in cases where the market is not completely transformed, as in Massachusetts with residential lighting. As MT programs affect target markets over time, both the programs and the evaluation plans may need to change to be able to continue impacting the markets and measuring the effects. –*Massachusetts Program Administrators*
- Program administrators should think carefully about where *their* market is. They should not just duplicate something that has been done successfully elsewhere, because it may be too late—or too early—for their region’s particular market. –*Massachusetts Program Administrators*
- It is necessary to move at the speed of markets. Working with market partners to change the way business is done or change product offerings requires not just shaping opportunities with market partners, but responding nimbly to opportunities as they arise. –*NEEA*

4.8.3 Data Collection and Market Progress Indicators

- Planners and implementers should work with evaluators early on to establish market progress indicators and ensure that appropriate information is being collected for evaluation. –*Massachusetts Program Administrators*
- Data on a wide range of information should be collected fairly frequently. Something that may at first seem unimportant can turn out to be critical information. For example, because the Massachusetts lighting program had regularly tracked bulb sales, storage, and usage rates, when CFL socket saturation stagnated despite strong program and non-program sales, it was possible to identify the reason (i.e., that a substantial portion of CFL sales was replacements for burned-out CFLs). –*Massachusetts Program Administrators*

- Evaluation approaches should be included as part of the program planning. Program administrators should make sure that data needed for evaluation are collected from program inception. An effort should be made to negotiate getting sales and other data as part of contracts with program partners. –*Massachusetts Program Administrators*

4.8.4 Necessary Conditions and Appropriate Expectations for MT

- It is possible for MT to be accelerated in a state without the market being permanently transformed. For market transformation to be permanent, it probably needs to happen at the national level. –*Massachusetts Program Administrators*
- Policymakers need to recognize that MT initiatives should to be approached differently depending on whether or not the program administrator is an investor-owned utility. –*Massachusetts Program Administrators*
- Program administrators should recognize that market transformation takes time—10 or 20 years, and sometimes more. (In recognition of this, NEEA measures cost-effectiveness over a 20-year period.) –*NEEA*
- The initial investment for MT tends to be high and to decrease over time. –*NEEA*

4.8.5 Collaboration and Communication

- Staff of programs with MT goals should be sure to know what is happening nationally and to communicate with peers in other states. To help ensure this, they should connect with national organizations such as the Consortium for Energy Efficiency and EPA ENERGY STAR, and with local organizations such as NEEP. –*Massachusetts Program Administrators*
- The value of a good implementation contractor with the right relationships cannot be overestimated. It's the implementation contractor who recruits upstream program partners and puts the work into maintaining relationships with them. If the implementation contractor does not do this well, the program will not be effective. –*Massachusetts Program Administrators*
- Program staff should be involved in evaluation planning and their input should be obtained when developing measurement instruments such as survey questions and data collection forms. Offer the program staff the opportunity to review draft reports. Sometimes the program staff have insights into future plans for the program that can have implications for the evaluation plan, data collection, and reporting. –*Massachusetts Program Administrators*

4.8.6 Home Performance Programs

- Home Performance programs should find the energy audit subsidy “sweet spot” (where the price is low enough that customers will pay, but not so low that customers will obtain an audit without any intention of following through on recommended measures). –*Efficiency Vermont*

- Customers, especially those who did not successfully complete the program, should be surveyed to help understand how to increase participation. (This also applies to new construction programs.) –*Efficiency Vermont*

4.8.7 New Construction Programs

- Having in-house energy raters and consultants with solid knowledge of building science performing much of the field work, and meeting with them regularly, helps to ensure that the program delivers high quality, consistent technical assistance. This technical assistance is valued by builders. Many builders have been working with the program for a long time and often speak out on its behalf. This helps the program reach more new homes in the state. –*Efficiency Vermont*
- It is important to plan for additional time to work with builders whenever new national program standards are released. ENERGY STAR and some other national new construction programs have become both more comprehensive and more complex. This increases the amount of time the builder needs to spend to ensure the home qualifies. This increase should be taken into account, and builders might need more “hand holding” when a new version of a national program rolls out. –*Efficiency Vermont*
- Lost opportunities should be evaluated at the building stage. –*Efficiency Vermont*
- Lack of comps, which are critical for appraisers to quantify the value of a home’s energy efficiency, is one of the biggest challenges to residential new construction programs. –*Efficiency Vermont*
- It is helpful to develop a constructive, open relationship with stakeholders (such as builders, HERS providers, Home Energy Raters, and contractors) to solicit their input, and to ask how the program can best support their efforts. –*NYSERDA*
- It is important to gather data for program evaluation from builders and others in real time. Macro-economic forces, such as economic downturns, may intervene in between program participation and evaluation. Allowing too much time to pass before collecting information can affect the validity of the resulting data. –*NYSERDA*

4.8.8 Lighting Programs

- The residential lighting market changes very quickly. This makes it difficult to know how to respond to stagnating socket saturation and impending federal legislation. –*Massachusetts Program Administrators*
- Evaluating the impact and market effects of lighting programs is difficult for a variety of reasons. With the exception of “memorable purchases” (expensive LEDs, redoing an entire room, etc.) consumers give lighting little thought, and unless you ask consumers questions about lighting purchases at the point of sale or soon after, bias from many sources can creep into the results. Retailers and manufacturers are extremely reluctant to assist evaluation efforts for fear of revealing too much to their competitors, making the

measurement of NTG and market effects challenging. –*Massachusetts Program Administrators*

- Lighting programs that wish to quantify program impact beyond their own borders should plan for this well ahead of time. –*Massachusetts Program Administrators*
- With residential upstream lighting programs, you need “boots on the ground” in the form of field- and circuit-riders. When you work with upstream market actors, you lose control. Field- and circuit-riders ensure that program materials, etc., are where they are supposed to be. It also helps to have conversations with upstream partners to ensure that these organizations are coordinated internally, since many of them are quite large and not everyone in these organizations who needs to know what is happening does know. –*Massachusetts Program Administrators*
- As the lighting market changes, it is important to come to an agreement on a new baseline—not CFL or incandescent, but something in between that will continue to change over time. –*Massachusetts Program Administrators*
- Program administrator staff should be prepared to talk with and listen to a lot of different parties—other program administrators’ staff, field staff, manufacturers, retailers, etc.—in order to keep up with the rapidly changing world of lighting. –*Massachusetts Program Administrators*

5 Summary of Approaches to MT and Discussion of Policy-Related Insights

This section begins with a summary of the approaches to MT program planning, design, implementation, and evaluation used by each of the four program administrators, as well as the lessons learned and advice offered by each. This is followed by a discussion of policy-related insights from the research with implications for strategic MT.

5.1 Efficiency Vermont

Role of MT: MT is a formal organizational objective.

Program planning and market research: Efficiency Vermont program planning is centralized and formalized through its strategic planning group. Each program develops or updates a “Market/Initiative Brief” on an annual basis. This document serves as the written program theory. Efficiency Vermont does not create graphic logic models for its programs.

Market research is the responsibility of the VT Public Service Department. The focus on market research appears to be relatively light. Efficiency Vermont supplements the VT Public Service Department’s market research in a limited way.

Market actors provide input on changes to established programs. It is not clear to what extent market actors were involved in the planning of the programs, but it appears there may have been some involvement for at least one of the programs examined. Efficiency Vermont is a sponsor of NEEP. NEEP develops regional program strategies with the input of market actors as well as Efficiency Vermont and other partner organizations.

Market scanning: Efficiency Vermont focuses on emerging markets where there is potential for high savings and ratepayer benefit. A specific approach to selecting markets was not discussed.

Use of logic models: The “Market/Initiative Brief” of each program serves as the program theory. Efficiency Vermont does not create graphic logic models for its programs.

Evaluation: The VT Public Service Department is responsible for the evaluation of Efficiency Vermont’s energy-efficiency programs. The cost-effectiveness is assessed at the portfolio level using the TRC test, which accounts for more than just energy savings.

Market progress tracking: Efficiency Vermont currently focuses primarily on the number of projects completed or savings acquired, rather than on other kinds of progress indicators.

Protocols: The VT Public Service Department neither has nor follows evaluation protocols specific to MT programs.

Attribution: For the programs examined, market-level NTG and/or indicator tracking were used.

Claiming savings from market effects: Not specified.

Transition or exit strategies: Not planned in advance.

Lessons learned: For new construction or whole house programs:

- Survey customers to help understand how to increase participation.
- Ensure program staff have solid building science knowledge.
- Evaluate lost opportunities at the building stage.
- Lack of comps for appraising the value of energy-efficient homes is among the biggest challenges for new construction MT.

5.2 Massachusetts Program Administrators

Role of MT: MT, along with resource acquisition, was a formal objective for the ENERGY STAR Lighting program from program inception through 2007. MT is not a formal objective of the State of Massachusetts.

Program planning and market research: The Massachusetts Program Administrators described a fairly informal, non-systematic approach to program planning and a somewhat more systematic approach to researching products or services to support.

The Program Administrators performed market research to establish a baseline at the beginning of the program. It appears there was some early input on program design by market actors, but the extent of this involvement is not clear. There was definitely market actor input after some of these actors had become program partners. It appears that, for program design in general, the implementation contractor and regional energy-efficiency organization (NEEP) provide planning input, with the implementation contractor bringing to the table his or her understanding of the program domain and target market, and that more formal research tends to take place after the program has begun.

The Massachusetts Program Administrators are sponsors of NEEP. NEEP develops regional program strategies with the input of market actors as well as the Program Administrators and other partner organizations.

Market scanning: According to one interviewee, the approach to researching products or services to support typically involves either an evaluation, such as that of a pilot program or installations, or using third-party information to assess products or services.

Use of logic models: While there is a logic model for the lighting program, it is not clear if the creation of logic models is common for other MT-focused efforts of the Program Administrators. NMR found only one logic model for the program, created fairly late (2007), suggesting that creating and updating logic models may not be a routine practice for the Program Administrators.

Evaluation: Program Administrators are responsible for evaluation. For this program, they have taken a market assessment-focused evaluation approach, including regular saturation and hours-of-use studies, consumer surveys, shelf stocking and pricing studies, and upstream interviews.

Evaluation consultants to the Energy Efficiency Advisory Council (EEAC) work with the evaluation staffs of the Program Administrators and the evaluation contractors to plan evaluations for the residential lighting program. Program staff is not currently involved in evaluation planning.

Market progress tracking: Market progress indicators were established early on and some have been tracked as frequently as annually for over a decade, even after the program could no longer be considered strategic MT. The choice of progress indicators is guided by the program theory.

Market progress indicators have changed somewhat over time with changes in the program, market, and evaluation budgets.

MT-specific evaluation protocols: None. General evaluation protocols are not prescriptive.

Attribution: Market-level NTG, performed every one to three years.

Claiming savings from market effects: Market effects for this and other programs claimed to the extent that the market effects are embedded in the NTG ratios.

Transition or exit strategies: Not planned in advance.

Lessons learned:

- MT interventions can dramatically change markets over time. Change programs and evaluation plans as necessary to be able to continue impacting the markets and measuring the effects.
- Tailor the intervention to the current state of the market in your state or service area.
- Planners and implementers should work with evaluators early on to ensure appropriate data collection. Plan for evaluation as part of program planning. Collect evaluation data from program inception.
- Involve program staff in evaluation planning and related document review.
- Collect data frequently on a wide range of information.
- Ensure program staff are aware of what is happening nationally and with peers in other states.
- Choose an implementation contractor with the right relationships.
- The residential lighting market changes very quickly. Program administrator staff should be prepared to talk with and listen to a lot of different parties to keep up with it.
- Evaluating the impact and market effects of lighting programs is difficult for a variety of reasons, including low salience of lighting among consumers and competitive concerns of retailers and manufacturers.
- Lighting programs that wish to quantify program impact beyond their own borders should plan early.
- For residential lighting programs working with retailers, have “boots on the ground” in the form of field- and circuit-riders.
- Come to an agreement on a new baseline as the lighting market changes.

5.3 NYSERDA

Role of MT: NYSERDA has defined MT. It is one of several strategies employed in programs within NYSERDA's portfolio.

Program planning and market research: NYSERDA is responsible for market research for its programs. The timing of market research is a function of input from the New York DPS, program staff, and previous evaluation findings. A pilot study was performed for the Home Performance Program prior to full implementation.

Market actors provided input for the initial design of both programs that were examined. These included the implementation contractor; organizations such as EPA, DOE, and the NYS Builders Association's Research & Education Foundation; and participating contractors.

NYSERDA is a sponsor of NEEP. NEEP develops regional program strategies with the input of market actors as well as NYSERDA and other partner organizations.

Market scanning: Not discussed.

Use of logic models: NYSERDA routinely develops and periodically updates logic models and related market progress indicators for its programs.

Evaluation: NYSERDA is responsible for program evaluation. NYSERDA evaluation staff work with consultants to develop evaluation plans using input from the NYS Department of Public Service, NYS Evaluation Advisory Group, and program staff. Evaluation plans must be approved by the NYS Department of Public Service. The logic models inform the evaluation plans and research objectives.

Market progress tracking: NYSERDA establishes and tracks market progress indicators tied to logic models as appropriate for each program.

MT-specific evaluation protocols: NYS Department of Public Service and Evaluation Advisory Group guidelines include an appendix devoted to the evaluation of spillover by NYS program administrators. While not specific to MT, the appendix includes guidelines for this measurement in the case of upstream market actors, which are commonly part of MT efforts. NYSERDA is in the process of developing guidelines that will be specific to the evaluation of the subset of spillover represented by market effects.

Attribution: For these programs, NTG is measured at the program level and supplemented by indicator tracking in some cases.

Claiming savings from market effects: For the programs reviewed, market effects were included implicitly in NTG.

Transition or exit strategies: Not planned in advance.

Lessons learned:

- Develop a constructive, open relationship with market actor stakeholders and solicit their input.
- Gather data for program evaluation in real time.

5.4 NEEA

Role of MT: NEEA develops and implements MT initiatives.

Program planning and market research: NEEA staff described a systematic, multistep initiative development process grounded in market research performed in the process of determining whether to enter a market. Among other steps, this includes conducting one or more market characterization studies and using the resulting information to inform the initiative development process, as well as conducting a third-party-evaluated assessment of the naturally occurring baseline. As part of program planning, NEEA develops a description of the anticipated life cycle for each initiative from birth to transformed market. The description includes evaluation deliverables at each phase of the initiative, from market characterization to measuring baseline to Market Progress Evaluation Reports (MPERs) to long-term monitoring and tracking of market progress. Evaluators and other NEEA staff are part of cross-functional program planning teams.

NEEA described market actors as being involved as partners in initiative planning and noted that they use intelligence from these market actors to shape initiative timing, strategies, and approaches.

Market scanning: NEEA gives a team of project managers the responsibility of scanning the market for new technologies with energy-efficiency potential and investigating the potential. NEEA looks for areas of untapped energy savings potential with market barriers that impede achieving the potential. A primary function of NEEA market research is to identify barriers to adoption of products or services.

Use of logic models: NEEA establishes these for programs early on and refines them as programs change over time.

Evaluation: NEEA is responsible for evaluation. As part of the process of vetting proposed initiatives for its portfolio, NEEA cross-functional program teams, which include evaluators, prepare evaluation plans for testing the market effects of each initiative. NEEA appears to have developed systematic approaches that result in a fair degree of consistency of evaluation across its initiatives.

Market progress tracking: The market effects evaluation approach is tied to the market progress indicators.

MT-specific evaluation protocols: None.

Attribution: Market-level net savings.

Claiming savings from market effects: NEEA funders claim the energy savings from the net market effects of NEEA initiatives.

Transition or exit strategies: NEEA plans the transition or exit strategy as part of program planning.

Lessons learned:

- Hire risk-takers who can sell.
- Move at the speed of markets and respond to opportunities as they arise.
- Market transformation takes time—10 or 20 years, and sometimes more.
- Expect the initial investment for MT to be high and to decrease over time.

5.5 Policy-Related Insights from the Research

Since obtaining policy-related insights was not the focus of this study, NMR did not systematically ask questions about policy or review policy-related documents. However, the research yielded a modest number of insights regarding policies with implications for strategic MT.

NEEA's focus on MT both supports and is supported by its funders' resource acquisition-style programs. All of this is part of the regulatory structure that undergirds MT in the region. A Massachusetts Program Administrator interviewee opined that claiming savings from programs' market effects may be simpler in states with a clear, consistent market transformation program track and framework. The Pacific Northwest is a prime example of such an area. While the track in New York is not quite as clear or focused as that of the Pacific Northwest, NYSERDA provides another example.

Both Massachusetts and NYSERDA are in the process of working out their approach to MT evaluation. NYSERDA has received guidance on conducting spillover research with upstream actors—a common strategy of MT—and is beginning the development of its own approach to the measurement of market effects. Massachusetts Program Administrator interviewees tend to believe that less prescriptive evaluation protocols may be preferable for MT, as these approaches allow methods to change as programs and markets change, but they plan to develop a process for the evaluation of market effects and aim to ensure methodological consistency across research areas and programs.

As a NEEA interviewee noted, if programs focused on transforming markets are to be treated like generation or other resources, the relatively long wait before MT efforts bear fruit must be taken into account in evaluation. This is in line with the comment of a Massachusetts Program Administrator interviewee that claiming savings from market effects or spillover is particularly challenging in situations where utilities administer energy-efficiency programs, as the short-term need to back up revenue recovery claims does not fit well with the long-term nature of market transformation. The calculation of NTG based on a program's effects within a single year, which has been the case in the past for the Massachusetts ENERGY STAR Lighting program, is an example of an evaluation timeframe that is too short to take market effects from MT into account. At the same time, these annual NTG measurements made it possible to capture the acceleration of the adoption curve, demonstrating the market effects of the Massachusetts program and thus partially overcoming the limitations imposed by this regulatory requirement.

Interviewees representing two program administrators that report to regulatory bodies, the Massachusetts Program Administrators and NYSERDA, commented on the value of collaborative approaches to program evaluation taken by their organizations. This suggests that, where program administrators report to regulators, an informal, collaborative approach to evaluation planning may benefit MT efforts. (Indeed, in the opinion of one Massachusetts Program Administrator interviewee, it may be the only way to address evaluation of a market transformation-oriented program administered by an investor-owned utility.)

One interviewee suggested that placing responsibility for market research with an organization other than the program administrator may impede carrying out timely market characterization studies that provide rich information to understand the dynamics of a particular market, including “knowledge of who influences who, how profits are made, where added value occurs, how pricing is done, and where the barriers and potential leverage points might be.”

Finally, the experience of the Massachusetts ENERGY STAR Lighting program—which started out as a strategic MT program with explicit MT goals, but became increasingly focused on near-term savings and eventually ceased to qualify as a strategic market transformation program—illustrates the difficulty of operating programs with MT goals while simultaneously attempting to meet ambitious resource acquisition goals.

6 Conclusions

The interviews and review of program reports suggest that the program administrators with programs examined for this study implement most of the planning, design, implementation, and evaluation practices that are identified in the literature as being effective for MT programs. There are a few exceptions, mostly practices that we were not able to examine for the study or practices carried out by NEEA alone.

We found that one practice, developing a graphic market model (3.1.4), is not routinely carried out by any of the program administrators. Four practices associated with planning for market transition or exit and tracking market effects after the program has ended are routinely carried out by only one program administrator. Below is a complete listing of the findings related to each practice from the literature.

6.1 Program Planning, Design, and Implementation Practices

6.1.1 Step 1: Identify Target Markets

In reviewing program documents, NMR found target markets identified for all but one program.

6.1.2 Step 2: Characterize the Market

The median length of time between studies with market research content was two years for the 11 programs for which this information was available. These findings provide evidence that the program administrators whose programs are examined here are implementing the practices of both characterizing the market and performing regular, ongoing research into the status of the market (3.2.3).

6.1.3 Step 3: Identify the Baseline

By definition, the program administrators had to establish baselines (in the sense of the counterfactual or what would have happened in the absence of the program, not necessarily the baseline conditions before the program started) for all 12 programs for which attribution was measured. NEEA explained that, as part of the market research and planning process, it conducts a third-party-evaluated assessment of the naturally occurring baseline. The VT Public Service Department measures baselines every few years for the Efficiency Vermont Residential New Construction and Home Performance with ENERGY STAR programs. Massachusetts interviewees noted, and the review of program reports showed, that there had been multiple calculations of the baseline as part of the annual studies for the lighting program. The review of program reports also yielded multiple baseline studies for several of the NYSERDA programs examined.

6.1.3.1 Related Practice: Ensure Ample Savings Possible

All four program administrators described some sort of process or test to ensure that there were sufficient potential savings to warrant pursuing MT or other program efforts. Of the four,

Efficiency Vermont and NEEA described the most systematic approaches to identifying products, services, and markets for intervention and program planning.

6.1.4 Step 4: Develop a Market Model

While NMR found written descriptions of how the market is supposed to work for 7 of the 14 programs, not one depicted the market model in graphic form.

6.1.5 Step 5: Develop Program Theory and Logic Model

NMR found a logic model flowchart, logic model table, or narrative of the program theory for all but 2 of the 14 programs.

6.1.5.1 Related Practice: Match Program Theory to Market Characterization

The study budget did not extend to assessing the degree to which the program theory or logic models matched the market characterization (Section 3.1.5.1).

6.1.6 Step 6: Develop a Market Transformation Story

Of the eight programs with publicly available logic model flowcharts or tables (not just program theory narrative), seven organized the outcomes by chronology, from short-term to long-term, and all had developed market progress indicators that were clearly linked with the logic model. This suggests that at least the three program administrators with logic models available have developed market transformation stories articulating linkages between program efforts and the future state of the market.

6.1.7 Step 7: Establish Interim and Long-Term Indicators of Market Effects

NMR found market progress indicators for 12 of the 14 programs across all four administrators. Seven of the eight logic model flowcharts or tables were organized by chronology, and the observations from in-depth interviews as well as the review of program reports provides evidence that the program administrators with logic models available are tracking indicators tied to these chronologically ordered expected outcomes.

6.1.8 Plan for Exit or Transition: Articulate an Exit or Transition Strategy for when Transformation is Complete

Only one of the program administrators, NEEA, identified a formal transition or exit strategy for the programs examined. According to a NEEA interviewee, all NEEA initiatives include a transition or exit strategy. In general, NEEA exits the market, changes its presence in the market, transitions support for the product or service to other entities such as industry groups or trade associations, or lets local utilities build on the framework and enhance the market, when a specific set of criteria is met. Interviewees for other organizations provided insights regarding informal transition strategies for these administrators' programs. Probably the best way to describe these transition strategies is how an interviewee for the Massachusetts Program Administrators put it: "Success will probably result in a new cycle" as technologies change. The

findings from in-depth interviews with the four program administrators indicate that the practice of articulating an exit or transition strategy as part of initial program planning is not widespread.

6.1.9 Step 9: Continue to Measure and Monitor Key Market Indicators After Transformation

Of the programs reviewed, only NEEA had exited the market for any of them. For these programs, NEEA continues to measure and monitor key market indicators.

As described in Section 3.1.10, we identified several other important planning, design, and implementation practices in addition to the above steps.

6.1.9.1 Working with Markets

Working *with* existing markets is critical. This involves the following:

- Recognize and use market forces.
- Find market allies who are willing to work with the program.
- Promote competition.
- Share risks with other market actors.
- Use upstream market actors to influence downstream adoption of energy-efficient products and services.

In the interviews, all the program administrators described some level of involvement in program planning by market actors—an element of recognizing and using market forces to achieve MT goals.

The tables in Section 4.4.1 offer evidence that these programs routinely include strategies targeted at both the supply and demand sides, as several of these practices suggest, including recognizing and using market forces, finding market allies who are willing to work with the program, and using upstream market actors to influence downstream adoption of energy-efficient products and services.

Table 4-2 in Section 4.2.5 showed the market actors identified in the program domains and target markets for each program. That end-users are so frequently part of the program domain reflects the high rate at which these programs attempt to transform markets through activities targeted all up and down the supply chain. The market actors identified in the target markets for these programs appeared to be reasonably representative of the respective supply chains.

6.1.9.2 Framing Benefits: Tie Non-energy Benefits to the Product or Service

While Efficiency Vermont and the Massachusetts Program Administrators both touched on issues with claiming non-energy benefits in their interviews, the research did not investigate the degree to which non-energy benefits were connected with the product or service promoted by the programs.

6.1.9.3 **Leverage Resource Acquisition: Leverage Resource Acquisition Tools or Programs**

Two of the program administrators—NEEA and Efficiency Vermont—were found to link to, leverage, or rely on another program using primarily a resource acquisition approach.

6.1.9.4 **Taking the Innovation Adoption Curve into Account**

Planning, designing, and implementing a program based on Rogers's theory of the diffusion of innovation involves the following:

- Focus on early adopters in opening markets for innovative products, including energy-efficient products.
- Avoid the “chasm” between adoptions by innovators and the general public, which for Rogers would include early adopters.

The research did not investigate the degree to which the programs focused on early adopters or how to avoid the chasm between adoptions by innovators and the general public.

6.1.9.5 **Getting Expert Advice: Form a Market-based Advisory Group to Help Shape and Review the Program**

All four Program Administrators described soliciting input from market actors in program design in various ways and at various times. Massachusetts, NYSERDA, and NEEA described collaborative approaches to evaluation planning involving parties such as program staff, evaluation staff, and evaluation consultants for regulatory commissions. Massachusetts, NYSERDA, and Efficiency Vermont all obtain input from market actors through NEEP.

6.2 Program Evaluation Practices

6.2.1 Match the Evaluation Strategy to the Program Logic

An assessment of the match between the evaluation strategy and the program logic was not within the scope of the study.

6.2.2 Track Indicators Tied to Expected Outcomes

NMR found market progress indicators listed in reports for 12 of the 13 programs. (The exception was a program for which only process evaluations were available.) We also found that the three program administrators with logic models available track indicators that are tied to expected outcomes.

6.2.3 Perform Regular, Ongoing Research into the Status of the Market

The description of findings for “Step 2: Characterize the Market” (3.1.2) also provides evidence that these program administrators perform regular, ongoing research into the status of the market.

6.2.4 Assess Market Effects Periodically

NMR found multiple assessments of attribution, including market effects, for several of the programs across the four administrators.

6.2.5 Refine the Program Theory and Logic Model

The review of documents provided evidence that two of the three program administrators with publicly available logic models or program theories have refined the programs’ logic models as the programs have changed over time.

6.2.6 Assess Attribution

NMR found program evaluation reports addressing attribution for 12 of the 14 programs. Attribution included a NTG calculation for 6 of these 12 programs. Of the six programs for which NTG was measured, three supplemented this with an assessment of attribution through market progress indicator tracking. Five programs assessed market-level net sales using market progress indicators to inform an estimate of the non-intervention baseline, and one tracked indicators without measuring either NTG or net sales. Eight programs supplemented the quantitative assessments with qualitative methods of some kind.

The three program administrators who confirmed that they claim savings from the programs’ market effects either for themselves or for their sponsors take different approaches to measuring attribution for the market effects, and in some cases the specifics of these approaches have varied over time.

6.2.7 Calculate Net Savings at the Market Level

The review of program documents showed that in the majority of cases (10 of 12), attribution was assessed for these programs at the market level.

6.2.8 Assess Sustainability and Prepare for Exit or Transition

All of the interviewees described key indicators on which a certain degree of progress would need to be made to determine whether the time has arrived to exit the market or transition the program. While the research did not explicitly examine the degree to which this information was used to inform change to the program over time, during interviews each of the administrators described a situation in which indicator progress resulted in a change to at least one program. Of the four program administrators, only NEEA develops transition or exit plans up front as part of initiative planning. (One NEEA interviewee, however, thought that NEEA's time horizon was too short and that it tended to exit markets too early.)

6.2.9 Tell the Market Transformation Story

As described in the discussion of Step 6 in this section, the research found evidence that the three program administrators with publicly available logic models had developed market transformation stories articulating linkages between program efforts and the future state of the market.

6.2.10 Continue Tracking Market Effects after the Program has Ended

As described above, only NEEA had exited the market for any of the programs and continues to measure and monitor key market indicators after transformation.

6.3 Other Key Findings

6.3.1 Claiming of Savings from Market Effects

The Massachusetts Program Administrators and NYSERDA are able to claim savings from market effects to the extent that these are embedded in the NTG ratios. NEEA funders are able to claim the energy savings from the net market effects of NEEA initiatives. It is unclear to what extent Efficiency Vermont claims market effects. Efficiency Vermont does claim savings for its Residential New Construction program on the difference between the baseline features of non-program homes in the state and the energy savings both from bringing program homes *up* to code and from taking them *beyond* code.

6.3.2 MT Evaluation Protocols

None of the program administrators was aware of MT-specific evaluation protocols for their state. NYSERDA operates under evaluation guidelines that provide general guidance on spillover attribution measurement and is developing market effects measurement guidelines, while Massachusetts Program Administrators operate under standardized approaches to estimating program-level net savings, but these are not prescriptive.

6.3.3 Policy-Related Insights

As obtaining policy-related insights was not the focus of this study, NMR did not systematically ask questions about policy or review policy-related documents. However, the research yielded a modest number of insights regarding policies with implications for strategic MT, including the following:

- Claiming savings from programs' market effects may be simpler in states or regions with a clear, consistent market transformation program track and framework, such as the Pacific Northwest or New York.
- Less prescriptive evaluation protocols may be preferable for MT, as these approaches allow methods to change as programs and markets change.
- If programs focused on transforming markets are to be treated like generation or other resources, the relatively long wait before MT efforts bear returns must be taken into account in evaluation.
- While the calculation of NTG based on a program's effects within a single year is an example of an evaluation timeframe that is too short to take market effects from MT into account, the fact that NTG has been measured nearly annually for residential lighting in Massachusetts has allowed for the acceleration of the adoption curve to be shown, thereby demonstrating the market effects of the Massachusetts program and partially overcoming the limitations imposed by this regulatory requirement.

Where program administrators report to regulators, an informal, collaborative approach to evaluation planning may benefit MT efforts. Several interviewees offered some important related insights, including the following:

- MT evaluation can be improved by involving program staff in evaluation planning and obtaining their input in developing measurement instruments, such as survey questions and data collection forms.
- It is wise to plan for evaluation as you plan the program and make sure to collect the data that will be needed for evaluation from program inception.
- Program administrators should try to negotiate getting sales and other data as part of contracts with program partners.
- Placing responsibility for market research with an organization other than the program administrator may impede carrying out timely market characterization studies that provide rich information to aid in understanding the dynamics of a particular market.
- It is difficult to operate programs with MT goals while simultaneously attempting to meet ambitious resource acquisition goals.

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7.1 Program Reports

NMR identified and reviewed the following publicly available reports in support of this study. This listing does not represent all the reports generated for the programs included in the study. In some cases, studies were either not publicly available or not available in electronic form. In addition, the reviewed reports focused only on a subset of study types. (For example, process evaluations and certain kinds of impact studies are not included in the listing because we determined them not to be relevant to the research questions.) The listing is organized by program administrator.

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Appendix A Program Profiles and Logic Models

Below are short descriptions and logic models of each of the eight programs on which NMR conducted more detailed investigation via in-depth interviews with program staff. The programs are:

- Efficiency Vermont's Home Performance Program and Residential New Construction Program
- The Massachusetts Program Administrators' ENERGY STAR Lighting Program
- NYSERDA's New York Home Performance with ENERGY STAR Program and New York ENERGY STAR Certified Homes (NYESCH) Program
- NEEA's Consumer Electronics TV Initiative, ENERGY STAR Clothes Washers Initiative, and Ductless Heat Pump (DHP) Initiative

The research team reviewed documents for an additional six strategic market transformation programs in the course of the research.

A.1 Efficiency Vermont Home Performance with ENERGY STAR and Residential New Construction Programs

A.1.1 Efficiency Vermont Home Performance with ENERGY STAR

The Home Performance with ENERGY STAR (HPwES) Program has been in existence since 2005. The program is designed to transform the market through training and building up a cadre of skilled, certified auditors and implementers of efficiency measures, with the goal of establishing a home energy-efficiency retrofit industry that would eventually not need support from Efficiency Vermont—such as discounts or incentives—to be sustainable.

The contractors who perform the energy-efficiency home audits are trained in an integrated whole-house approach that looks at a house as a system. Contractors are offered a small incentive for reporting data to the program, but are not directly paid to participate. The program also provides marketing support for contractors to promote their whole-house energy-efficiency services. As the program evolved, it focused more on providing incentives to homeowners to create demand for whole-house efficiency services and reducing the cost barriers to doing so.

The program is designed not to interfere in the business relationship between the contractor and the customer. There are few dictated business requirements. For example, while an energy audit is required for the program, there is no set price for the audit (though it must align with BPI standards). Currently, customers receive a \$100 audit subsidy, which contractors offer as an instant rebate. Contractors are then reimbursed when the audit data are reported. Contractors are free to conduct a no- or low-cost walkthrough prior to doing a comprehensive audit as long as a comprehensive audit does take place before work begins.

As reported in the 2013 Impact Evaluation of the program, based on the Efficiency Vermont website, a typical HPwES project proceeds in the following way:

[Each] project starts with a home comprehensive energy audit conducted by a Building Performance Institute (BPI)-certified HPwES contractor. Upon completion of the audit, homeowners are provided with a report outlining suggested home improvements and the associated energy savings. If the homeowner decides to move forward, the HPwES contractor then installs the recommended improvements and tests out the project according to BPI standards. The most commonly installed measures are insulation and air sealing. However, other improvements may include heating system replacement and distribution, domestic hot water or electric efficiency measures.⁸⁸

The contractor provides an estimate of the total Efficiency Vermont incentive the project would receive if all measures are installed as recommended. The actual incentive given to the homeowner is based on the energy-saving home improvements completed by the contractor.

A.1.1.1 Efficiency Vermont Logic Model

In lieu of a logic model, Efficiency Vermont requires each program to develop or update a “Market/Initiative Brief” annually. The template guides program staff in developing what is essentially the program theory. It includes much of the same information that would be found in a logic model, including indicators of progress toward goals for the program and the market. The elements of the Market/Initiative Brief template are listed below.

Summary of the market and the initiative, including:

- A general description of the market, including drivers and trends, customer value propositions, and how decisions are made
- A general description of how the initiative approaches the market and targeted market segments, and how it serves the market
- A description of where the initiative is in the market, and overall progress toward market transformation (e.g., status of past and current activity, penetration rate, etc.)
- Key market actors, their concerns, and actor-specific barriers to efficiency
- Barriers and opportunities at the levels of both market and technology

Long-term vision for the market and initiative, including:

- Long-term (10-year) vision for the market and the initiative
- Three-year performance goals for the market and the initiative
- Any related goals associated with the Demand Resource Plan or Quantifiable Performance Indicators associate with the initiative

⁸⁸ West Hill Energy and Computing, Inc., and GDS Associates, “Efficiency Vermont’s Home Performance with ENERGY STAR Program: Impact Evaluation,” submitted to Efficiency Vermont (2013), 9.

Annual goals and strategies for the market and initiative, such as:

- High-level expectations for the market and initiative (for example, speed of market change and size of opportunity versus expected program cost or budget)
- Annual goals for the next year (savings and non-savings)
- Key strategies and approaches for the next year
- Policy or legislative changes that may be driving new strategies
- Implementation considerations, including staffing and budget needs

A.1.2 Efficiency Vermont Residential New Construction Program

Efficiency Vermont's Residential New Construction (RNC) market transformation program, established in 2000, is based on a holistic view of the house as a system. The program partners with VT Gas Systems, which ran a RNC program prior to the establishment of Efficiency Vermont. The end goal for the program is net zero energy use by 2030 for all new homes.

The program is designed to overcome the following market barriers:

- It is cheaper to build a house that is not to code than to build one that is at or above code.
- There are builders in VT that are building houses that are not to code.
- The up-front cost to building to higher energy-efficiency requirements.

For information on how Efficiency Vermont develops its logic model, please see Section A.1.1.1.

A.1.2.1 Steps in Program Participation

A participant is enrolled in the program and is assigned an Efficiency Vermont energy consultant. The consultant works with the enrollee, starting with technical consulting, through to site visits, consultation planning, etc. Ideally, Efficiency Vermont works with an enrolled project from design through project completion.

The RNC program provides free energy ratings and technical assistance for all enrolled homes. It also provides incentives to builders based on the home's HERS index and number of CEE Tier 2/3 appliances installed as well as marketing advice and materials. The program targets other supply-side market actors through trainings for real estate professionals and municipalities.

There are currently three program tier levels above the standard VT code for which participants can aim: Energy Code Plus (Bronze), VT ENERGY STAR Homes (Silver), and the new pilot High Performance Homes tier (Gold). Program outputs include:

- Cash incentives
- An energy code certificate for the builder to sign
- A home energy rating certificate
- Documentation for tax purposes
- Efficiency Vermont certificates of recognition for each tier

- Meetings of the VT Green Home Alliance
- The substantial, individualized technical assistance given to each enrollee
- Marketing advice or materials for builders, especially for ENERGY STAR,
- Home monitoring to demonstrate modeled savings in selected homes
- Air quality monitoring in selected homes
- Trainings for building professionals, real estate professionals, and municipalities

Efficiency Vermont is currently piloting a High Performance Home tier. Homes meeting this tier have extremely low energy loads. The RNC program is demonstrating the new technologies and techniques for these builders to show them that they can be cost-effective for the builders. As this becomes more evident, and energy savings are dramatic, Efficiency Vermont expects to overcome these barriers.

A.2 Massachusetts ENERGY STAR Lighting Program

This study focuses on the Massachusetts ENERGY STAR Lighting Program from its inception in 2002 through 2007, during which time the program was described by its sponsors as “both a resource acquisition and a market transformation program.”⁸⁹ As the program theory in Section A.2.1 shows, the program was designed to overcome specific market barriers for each of three target audiences: consumers, manufacturers, and retailers. Market effects, and ultimately market transformation, were the theorized program outcomes. As with other programs included in this study, many of the program’s strategies for increasing the use of high efficiency lighting in homes focused “upstream” on retailers and manufacturers rather than on lighting end-users.

The program’s 2007 Market Progress and Evaluation Report (MPER) describes the program during the time as follows:

The Massachusetts ENERGY STAR Lighting Program is an on-going effort to encourage the use of ENERGY STAR-qualified lighting among residential customers. For many years the Massachusetts Sponsors, both individually and collectively, have had active energy-efficient lighting programs that included catalog sales, retail coupons, and consumer education. The Sponsors also work with other regional programs through the Northeast Energy Efficiency Partnerships (NEEP) to leverage program effectiveness by aggregating markets and coordinating consumer messaging. Additionally, all Sponsor lighting initiatives are coordinated with and designed to support the national ENERGY STAR program.

Since 2002, the Sponsors’ Lighting Program has included three basic components:

The ENERGY STAR Lights catalog (and website)

Instant rebate coupons

⁸⁹ Nexus Market Research, RLW Analytics, and Dorothy Conant, “Market Progress and Evaluation Report (MPER) for the 2007 Massachusetts ENERGY STAR® Lighting Program” (July 2008).

Negotiated Cooperative Promotions (NCPs)⁹⁰

The dominant element of the program is Negotiated Cooperative Promotions. This refers to a high-volume sales initiative with manufacturers and retailers. Through these promotions,

The program invites industry partners to propose plans using either a markdown mechanism (which bases all of the incentive payments on sales data) or a buydown mechanism (which pays the majority of the incentive to the industry partner upon receipt of confirmed shipment reports and the remaining amount based on confirmed sales data). Both markdowns and buydowns provide reduced product pricing for the consumer.

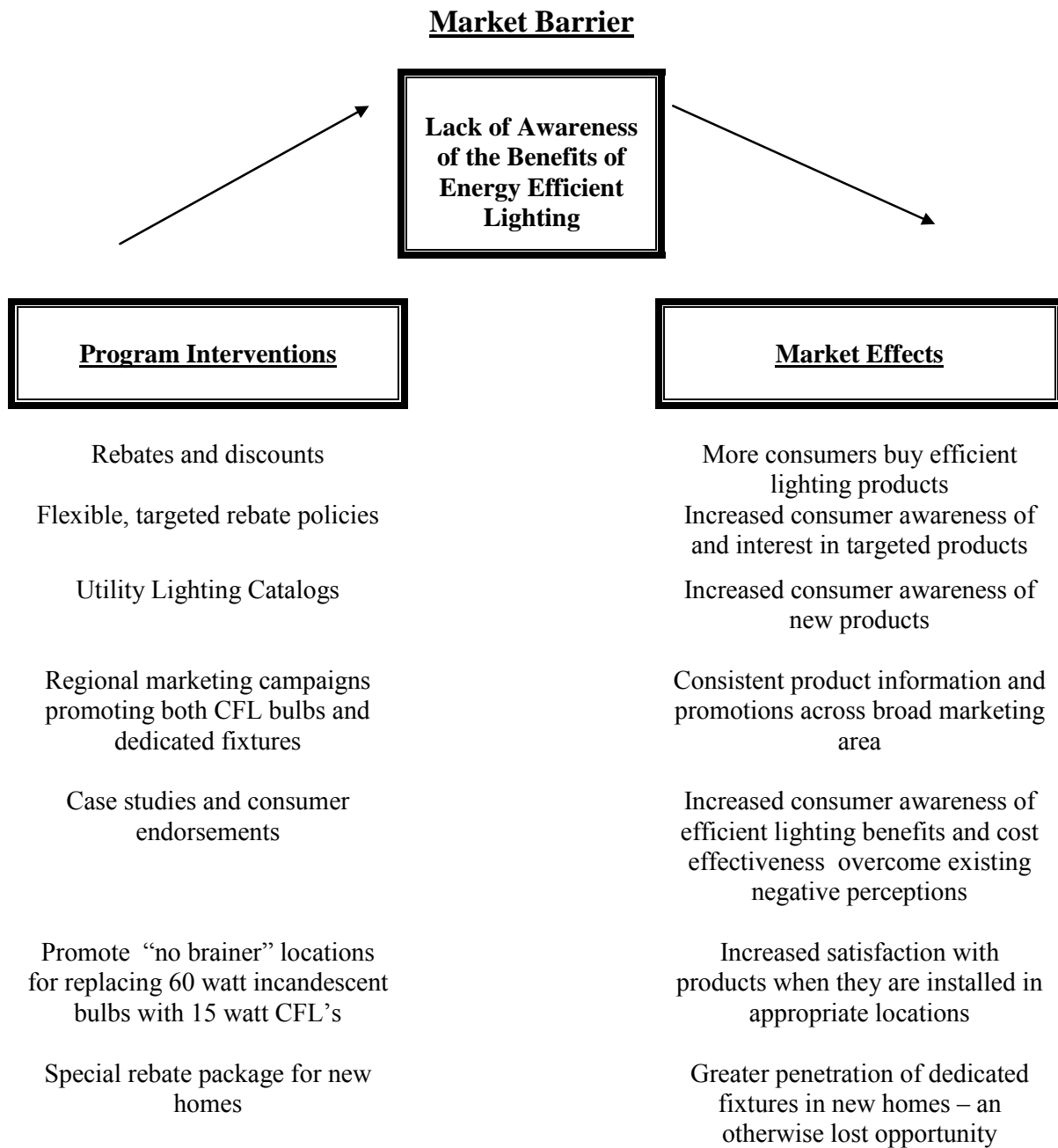
. . . A coupon program with retailers and a program catalog of ENERGY STAR-qualified lighting products also provide consumers with products at reduced pricing. Together, the programs incorporate market transformation strategies, services targeted directly to end-users and to key trade allies, and strategies to minimize lost opportunities. The programs produce long-term energy and demand savings as well as other resource and non-resource benefits.

A.2.1 Massachusetts ENERGY STAR Lighting Program Logic Model

Following are three tables presenting the program theory for the MA Lighting Program. The first addresses consumers, the second addresses retailers, and the third addresses manufacturers. These tables show market barriers, program interventions, and expected market effects.

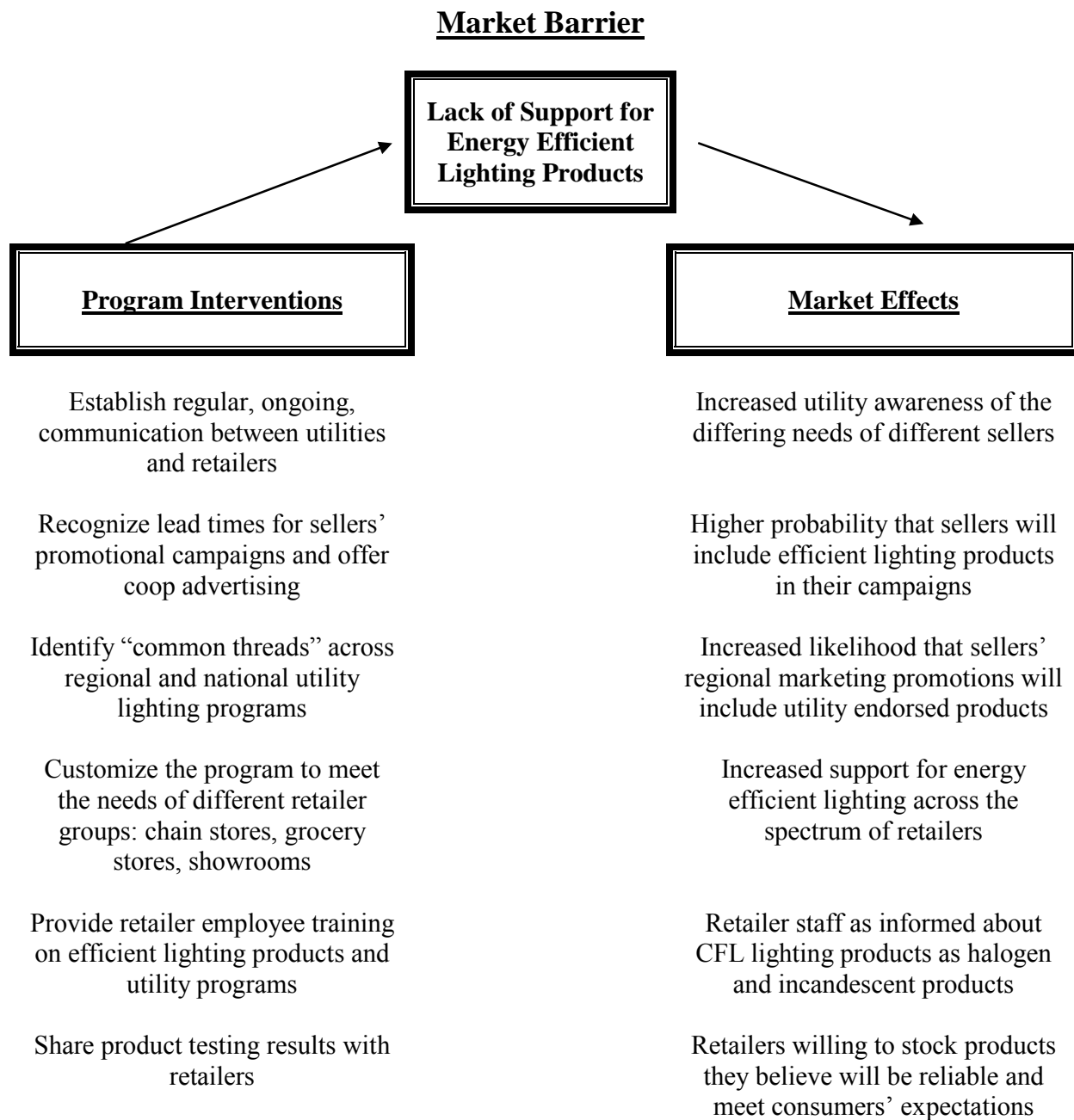
⁹⁰ Ibid., 1.

Figure A-1: MA ES Lighting Program Theory—Consumers



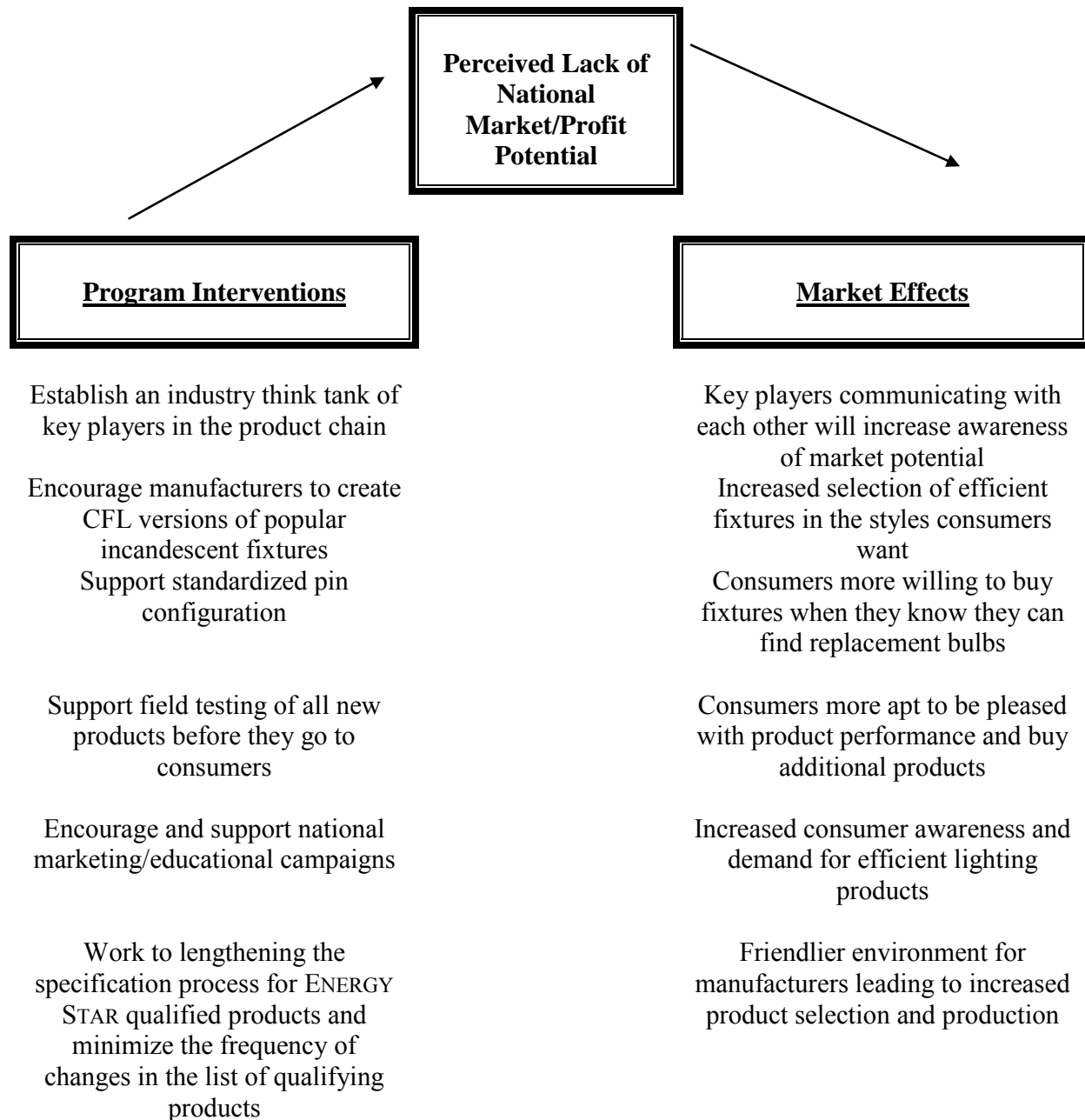
Source: Nexus Market Research, RLW Analytics, & Dorothy Conant. “Market Progress and Evaluation Report (MPER) For the 2007 Massachusetts ENERGY STAR® Lighting Program: Volume 1 Findings and Analysis,” Prepared for Energy Efficiency Advisory Council Consultants, Cape Light Compact, NSTAR, National Grid, Unitil, and Western Massachusetts Electric (2008).

Figure A-2: MA ES Lighting Program Theory—Retailers



Source: Nexus Market Research, RLW Analytics, & Dorothy Conant. “*Market Progress and Evaluation Report (MPER) For the 2007 Massachusetts ENERGY STAR® Lighting Program: Volume 1 Findings and Analysis*,” Prepared for Energy Efficiency Advisory Council Consultants, Cape Light Compact, NSTAR, National Grid, Unitil, and Western Massachusetts Electric (2008).

Figure A-3: MA ES Lighting Program Theory—Manufacturers
Market Barrier



Source: Nexus Market Research, RLW Analytics, & Dorothy Conant. “Market Progress and Evaluation Report (MPER) For the 2007 Massachusetts ENERGY STAR® Lighting Program: Volume 1 Findings and Analysis,” Prepared for Energy Efficiency Advisory Council Consultants, Cape Light Compact, NSTAR, National Grid, Unitil, and Western Massachusetts Electric (2008).

A.3 NYSERDA New York Home Performance with ENERGY STAR and NYSERDA New York ENERGY STAR Homes

The New York residential housing market consists of two submarkets: existing homes and new construction. NYSERDA’s New York Home Performance with ENERGY STAR® (HPwES) Program serves the existing homes market and the New York ENERGY STAR Certified Homes (NYESCH) Program serves the new construction market. Both programs are under the umbrella of NYSERDA’s combined Home Performance Program, which aims to improve the energy efficiency of New York’s residential marketplace.

Both the Home Performance with ENERGY STAR and New York ENERGY STAR Certified Homes programs intervene in their respective markets by targeting primarily supply-side market actors. However, both programs also include strategies to increase demand for the products and services promoted by the programs through marketing and, in the case of Home Performance with ENERGY STAR, provide financing options and incentives directly to consumers.

A.3.1 NYSERDA New York Home Performance with ENERGY STAR Program

As shown in the logic model for this program (see Section A.3.1.1), the ultimate goal, or desired outcome, of this program is to increase the energy efficiency of one- to four-family existing homes in New York, with concomitant sustainable energy savings and environmental benefits. Baseline research shows that the housing stock of existing homes in New York State is older and less energy efficient.⁹¹

The program aims to achieve this goal by promoting both the supply and the demand for retrofitting existing homes toward greater energy efficiency using a “house-as-a-system” approach, essentially creating a market for such services. It promotes the supply of these services through recruiting, training, and supporting BPI certification for contractors so they can become skilled at providing comprehensive home energy assessments and specifying and installing energy-efficiency measures to increase the efficiency of existing homes. The program promotes homeowner demand for these services by providing cooperative advertising for contractors and creating separate marketing and awareness programs targeting homeowners. Finally, it reduces one of the major barriers to homeowner implementation of these services—the cost of home energy assessments and energy-efficiency measures—by providing financing options and direct incentives to homeowners for having assessments and installing recommended measures. Although providing incentives to end-users is typically considered indicative of a resource-acquisition approach, in this case the incentives are not primarily for the purpose of obtaining direct savings, but rather for the broader purpose of creating demand in the context of a new market, which can be considered a market-transformation objective.

As described in the 2010 Logic Model Report for this program:

⁹¹ GDS Associates, “System Benefits Charge: Home Performance with ENERGY STAR Program Logic Model Report,” submitted to NYSERDA (2010).

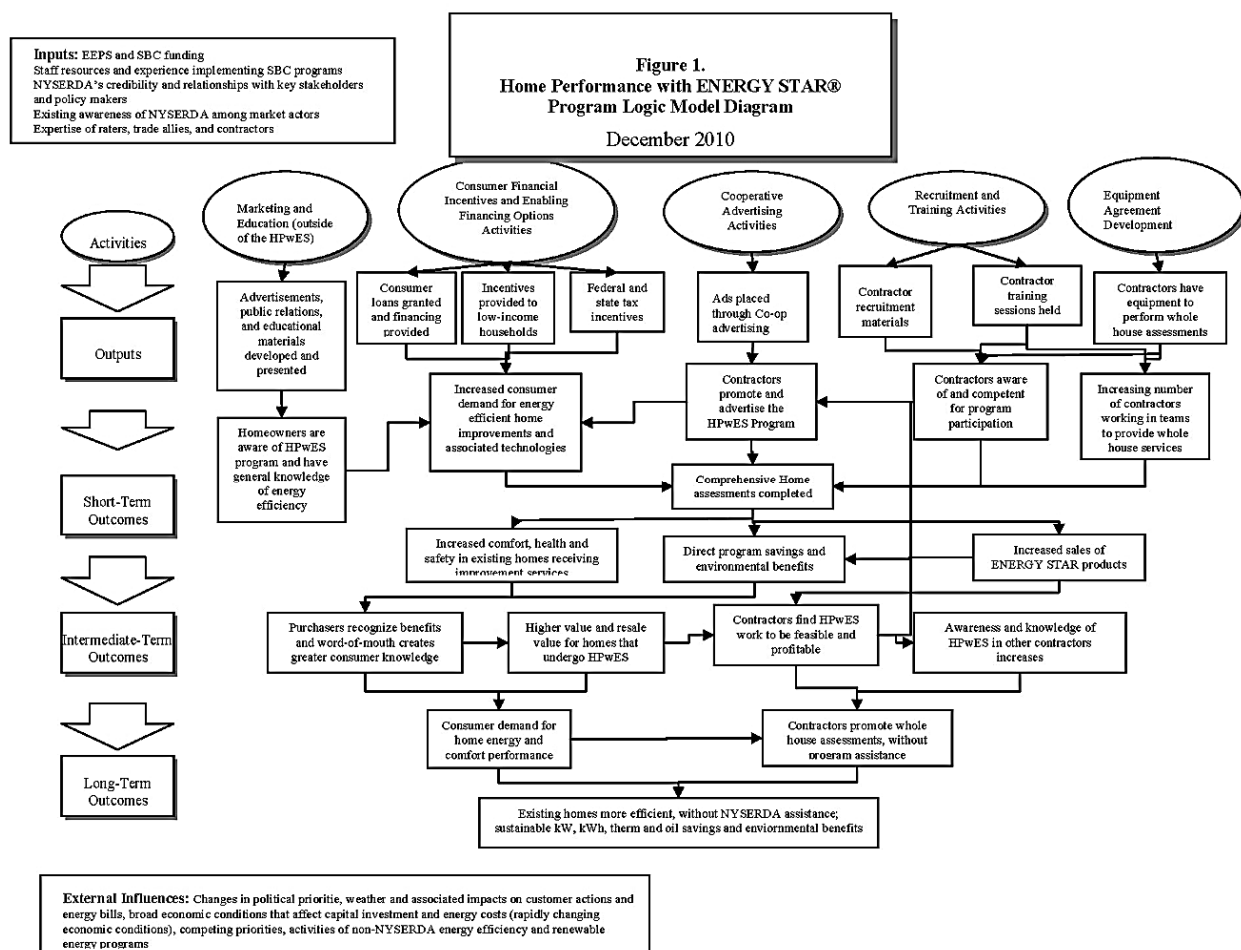
The New York HPwES Program encourages qualified contractors to implement comprehensive energy efficiency-related improvements and technologies as part of their regular business practices. HPwES raises the bar of energy efficiency and best practices for home improvement contractors through training and certifying individual technicians and accrediting firms. The Building Performance Institute (BPI) is the national organization used for certifying contractors and accrediting their companies . . . Comprehensive improvements are encouraged through the program and include building shell measures, heating and cooling measures, electric measures, and health and safety features.

Qualified contractors are required to complete performance-based Comprehensive Home Assessments (CHAs) that use advanced diagnostic testing equipment and energy modeling computer software. These tools help home performance contractors understand how well, or efficient the homes are functioning, and identify which measures are most needed and which measures, individually and in combination, will achieve a targeted level of cost-effective investment. Results of the CHAs are used by these contractors and homeowners to help prioritize and select measures for installation and to qualify projects for financing. The Program's primary consumer incentive is the Homeowner Financing Incentive (HFI), providing cash back for [a portion] of the cost of the eligible measures. . . . ENERGY STAR financing is also offered directly through the contractors, which results in a one-stop shopping experience for consumers.⁹²

⁹² Ibid., 3.

A.3.1.1 NYSERDA Home Performance with ENERGY STAR Logic Model

Figure A-4: NYSERDA Home Performance with ENERGY STAR Logic Model



Source: GDS Associates, “System Benefits Charge: Home Performance with ENERGY STAR Program: Logic Model Report,” Submitted to NYSERDA, 2010.

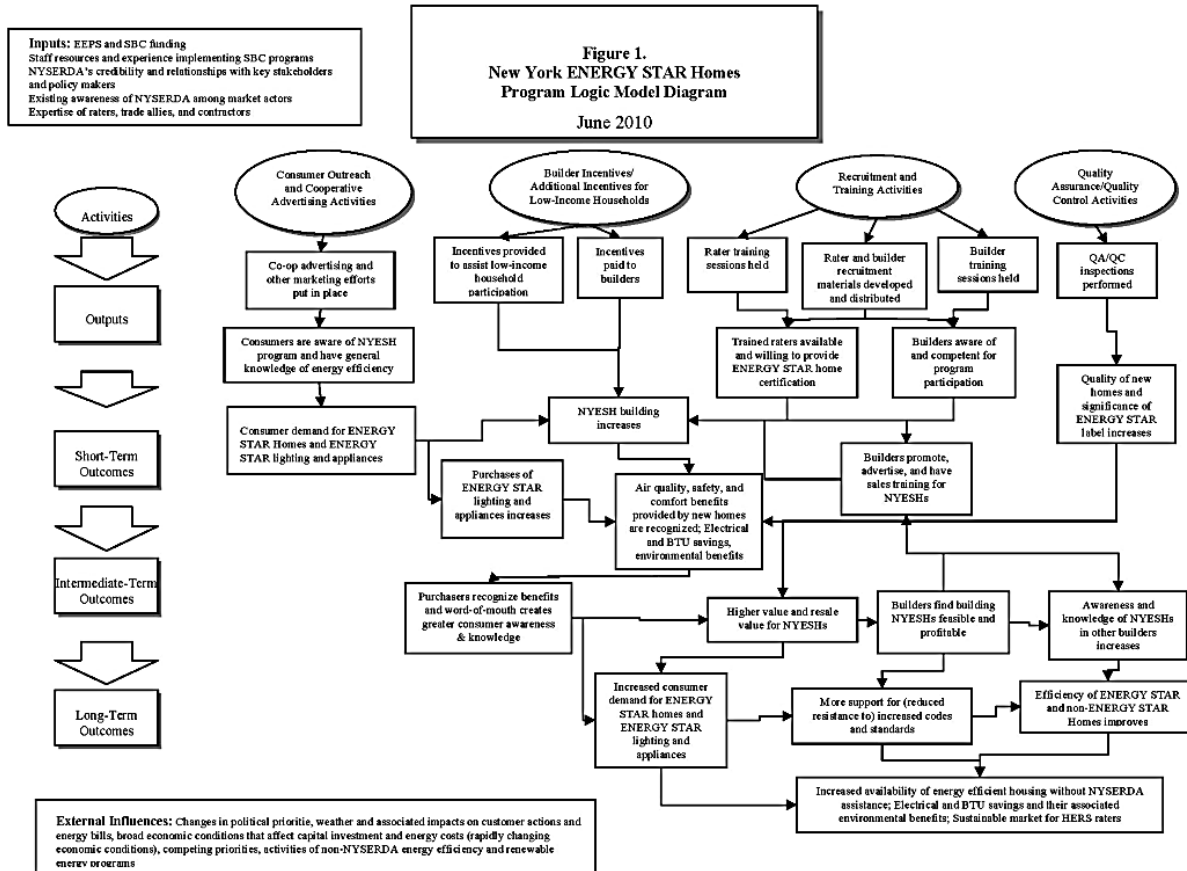
A.3.2 New York ENERGY STAR Certified Homes

The New York ENERGY STAR Certified Homes (NYESCH) Program is the new construction part of the Home Performance Programs. To encourage builders of one- to four-family homes and low-rise multifamily buildings to adopt energy-efficient design features and equipment, the program provides technical assistance and financial incentives to builders who build homes that meet the NYESCH Program criteria. The program actively recruits builders, HERS Providers, and Home Energy Raters to participate in the program and offers incentives to builders and HERS Providers. Quality assurance checks of NYESCH homes are also conducted through the program. New homes qualify as NYESCH if they meet the program’s above code performance and prescriptive measures, which include a qualified ventilation system, minimum electrical savings measures, and performance verification by a HERS rater.

On the demand side, the program includes consumer outreach activities such as participation in home shows, local events, etc., and provides cooperative advertising incentives to support builders’ promotion of their NYESCH homes and Home Energy Raters’ promotion of their services to builders. In addition, a consumer-based incentive is available to low-income homebuyers.

A.3.2.1 NYSERDA ENERGY STAR Homes Logic Model

Figure A-5: NYSERDA ENERGY STAR Homes Logic Model



Source: GDS Associates, “System Benefits Charge: New York ENERGY STAR Homes Program: Logic Model Report,” Submitted to NYSERDA, 2010.

A.4 NEEA Initiatives: Consumer Electronics TVs, ENERGY STAR Clothes Washers, and Ductless Heat Pumps

All of NEEA’s initiatives reflect a strategic market transformation approach and aim to create markets for energy-efficiency products and technologies for which essentially no market exists. In general, NEEA’s programs target upstream and midstream market actors, reducing supply-side barriers with little emphasis on offering rebates or incentives to end-users.

A.4.1 NEEA Consumer Electronics TV Initiative

As shown in the Initiative Logic Model (see Section A.4.1.1), the program aims to increase the availability and market share of energy-efficient televisions, with the long-term goal of establishing an ENERGY STAR 5.1 Federal Standard.

As described on the NEEA website,⁹³ market barriers include the fact that the television market lacks availability of energy-efficient options and that it is difficult for retailers and consumers to identify which televisions are more efficient.

The initiative's basic strategy to overcome these barriers is as follows:

*The Initiative engages with retailers to establish and maintain relationships with corporate staff, provide energy-related information, and pay-per-unit incentives for sales of qualified televisions. The Initiative expects these activities to motivate retailers to include more energy-efficient televisions in their assortment (the number and type of televisions a retailer makes available in its stores or online) than they would, absent the Initiative. The Initiative also expects a secondary effect, in which retailers' demands for televisions that meet Initiative qualification criteria influence manufacturers to design more energy-efficient televisions.*⁹⁴

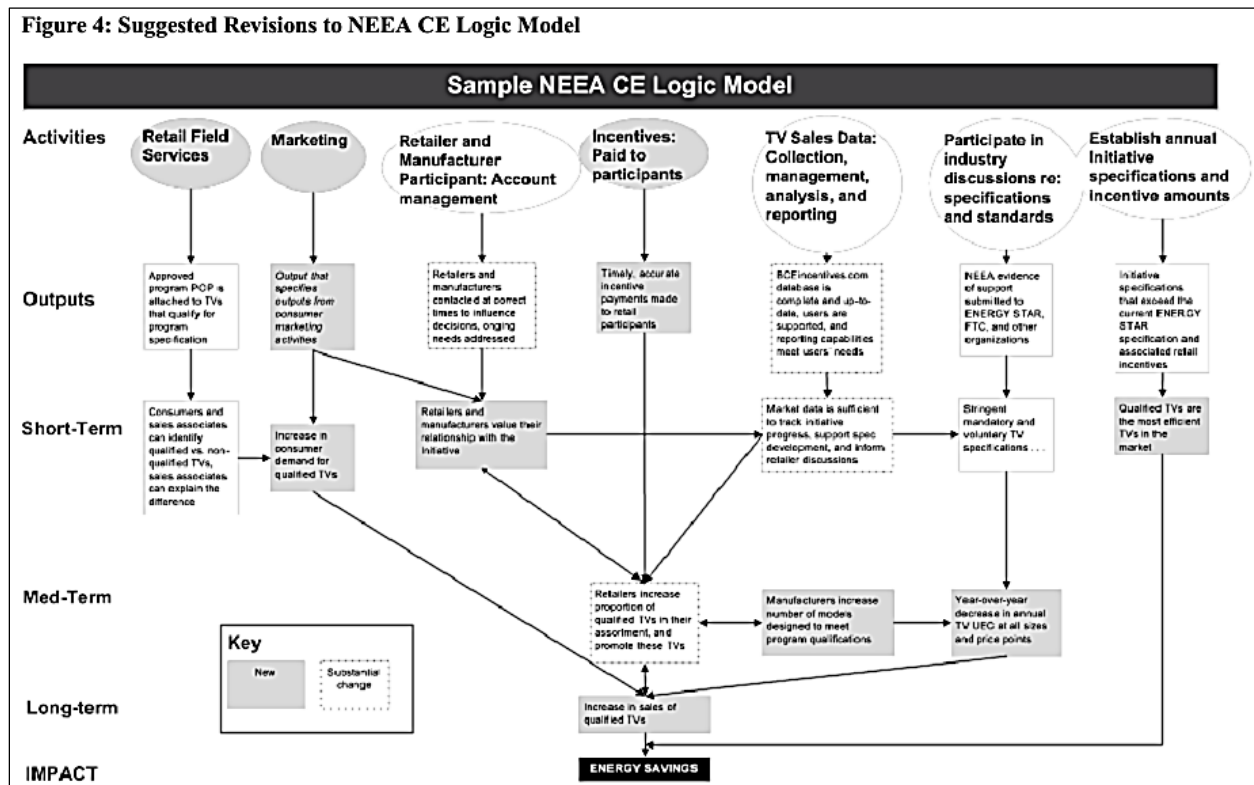
A.4.1.1 NEEA TV Initiative Logic Model

The following logic model was suggested by the evaluator team as an improvement on the then-existing logic model. It is not clear whether this model has been or will be adopted as the Program Logic Model.

⁹³ <http://neea.org/initiatives/residential/televisions>

⁹⁴ Research Into Action and Nicole de Horatius, "Consumer Electronics Television Initiative Market Progress Evaluation Report #2," submitted to NEEA (2013), 2.

Figure A-6: NEEA TV Initiative Logic Model



Source: Research Into Action and Ecos, “Consumer Electronics Television Initiative Market Progress Evaluation Report #2,” Submitted to Northwest Energy Efficiency Alliance, 2013.

A.4.2 NEEA ENERGY STAR Clothes Washers Initiative

The ENERGY STAR Resource-Efficient Clothes Washer (ES-RECW) Program started as the WashWise Program in 1997, and changed substantially over time. The original WashWise Program targeted both retailers and consumers, offering a consumer rebate for qualifying washers as well retailer incentives for selling them. In addition, the Program focused on informing appliance retailers about the program and training them to market and sell qualifying washers.

At the end of 1997, the retailer and consumer incentives were reduced. Because the response to the original incentives was so robust, it was thought that such high incentives were no longer necessary. However, small incentives were given to salespeople per qualifying washer sold. At the same time, the Program planned to eliminate consumer incentives altogether in the next phase of the program and change to an ENERGY STAR program and marketing platform in 1998. The program was changed from WashWise to the ENERGY STAR Resource-Efficient Clothes Washer Program. Over the next few years, the program continued the same strategies

and included more types of appliances. The program ended in 2001, having been considered to have transformed the market for resource-efficient clothes washers.⁹⁵

A.4.3 NEEA Ductless Heat Pump Initiative

The purpose of this initiative is to create a market for Ductless Heat Pumps (DHPs) for electrically-heated homes, a market that, prior to the initiative, was essentially non-existent in the region.

As described in the initiative's Market Progress Evaluation Report #2,

In October of 2008 NEEA launched the Northwest Ductless Heat Pump Project, a regional pilot aimed at demonstrating the use of inverter-driven ductless heat pumps (DHPs) designed to displace electric resistance heat in existing Northwest homes. It is estimated that there are approximately one million electrically heated homes in the Northwest region, and DHPs have high potential to deliver significant energy savings. Based on findings from the regional pilot that ended in December 2009, NEEA initiated a full-scale initiative in 2010.

NEEA's work is focused upstream to promote product availability, support local utility initiatives, and build consumer and market awareness, with the ultimate goal of market transformation.⁹⁶

The initiative's main objectives include the following:

- Partner with Northwest Utilities and energy-efficiency organizations to achieve a 15% market share of ductless heat pumps by 2014 in single-family electrically heated homes
- Increase consumer awareness of ductless heat pump technology
- Maintain and enhance robust trade ally network
- Increase DHP product variety and availability throughout the region
- Increase affordability of DHPs throughout the region⁹⁷

It accomplishes these objectives through partnering with retailers to get DHPs displayed in stores and advertised in radio and television commercials, creating a website, partnering with lenders to offer financing for consumers who wish to install DHPs, and training contractors to install DHPs.

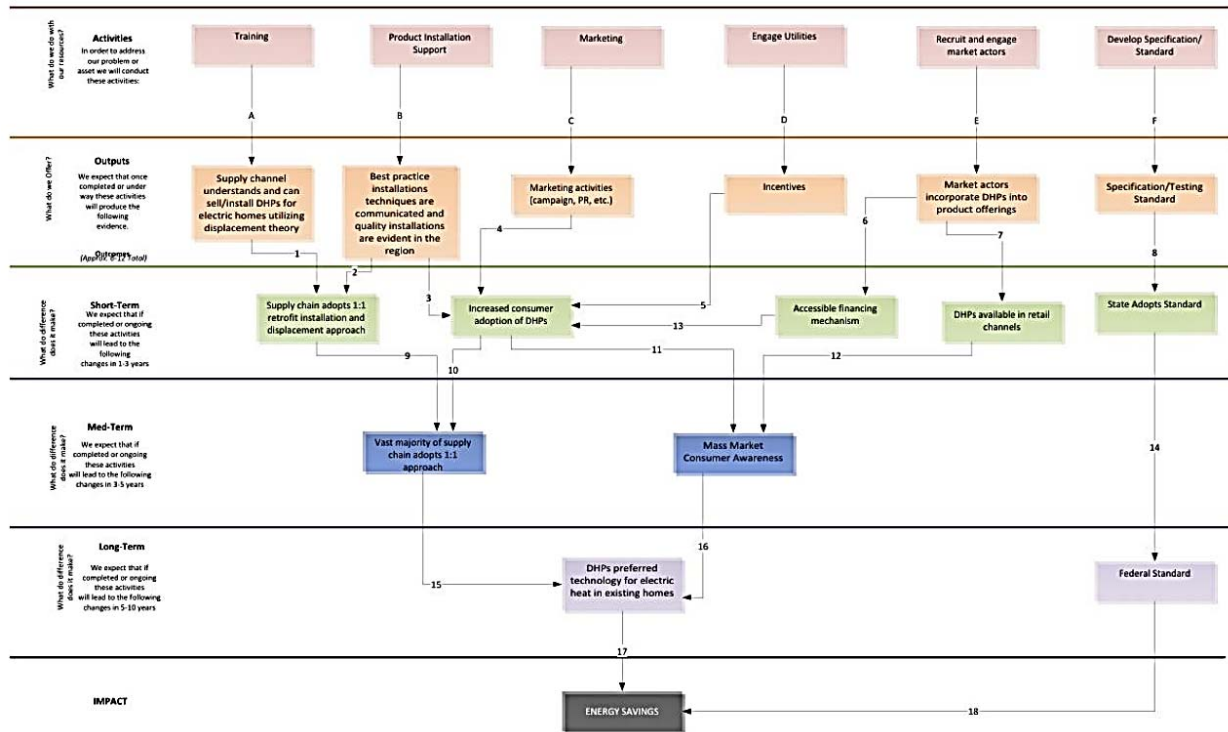
⁹⁵ Summarized from Pacific Energy Associates, "ENERGY STAR Resource-efficient Clothes Washer Program: Market Progress Evaluation Report #5," submitted to NEEA (2001).

⁹⁶ Evergreen Economics, "Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #2," submitted to NEEA (2012), p. 0.

⁹⁷ Ibid., 1.

A.4.3.1 NEEA Ductless Heat Pump Initiative Logic Model

Figure A-7: NEEA Ductless Heat Pump Initiative Logic Model



Source: Evergreen Economics, “Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #2,” submitted to Northwest Energy Efficiency Alliance (2012).

Appendix B Materials to Support MT Initiative Development

The tables below are meant to help PG&E, SCE, SDG&E and Southern California Gas learn more from the programs reviewed for this study.

B.1 Program Strategies Identified in Reports

Table B-1: Lighting Program Strategies

Program Strategies and Market Actors Targeted		Program Type & Administrator		
		Lighting		
		Efficiency VT**	MA Program Administrators***	NEEA*
		Strategy Used? ●=strategies that appear to be more central to the program ○=strategies that appear to be less central to the program (○)=strategy was reduced or dropped as the program evolved		
Upstream Market Actors Targeted				
Manufacturers				
Strategies	Buydown		●	(○)
	Share info about advancing efficiency technologies	●		
	Engage to ensure product availability	●		
	Leverage manufacturer resources and marketing			○
	Engage in developing product specifications			●
	Leverage utility incentives w manufacturers and retailers			●
Distributors				
Strategies	Engage in developing product specifications	●		●
	Share info about advancing efficiency technologies	●		
	Engage to ensure product availability	●		
Midstream Market Actors Targeted				
Retailers				
Strategies	Markdown	●	●	●
	Market lift buydown	○		
	Share info about advancing efficiency technologies	●		
	Engage to ensure product availability	●		
	In-store merchandising support			●
	In-store staff training	●		●
	Marketing support/cross promotions	●	●	●
	In-store demonstrations and events	○		○
	POS Materials	○		
	Mass advertising and branding	●		●
	Leverage resources and marketing			●
	Engage in developing product specifications			●
	Leverage utility incentives w manufacturers and retailers			●
	Develop product catalog		○	
Downstream Market Actors Targeted				
End-users				
Strategies	Coupons	○	(○)	
	Mass advertising and branding	●		●
	Consumer education/awareness-building	●		●
	Leverage retail/manufacturer resources and marketing			●
	Develop product catalog		○	
	Marketing coordination with EPA	○		
Other Market Actors Targeted				
Utilities				
Strategies	Mass advertising and branding			●
	Coordination on specification development			●
	Leverage utility incentives w manufacturers and retailers			●
	Staff support			○
Architects, designers				
Strategies	Informational material			○
EPA				
Strategies	Coordination on specification development			●
	Marketing coordination with EPA	○		

*Strategies mentioned in 2008 report
 **Strategies mentioned in 2013 report
 ***Strategies mentioned in 2008 report

Table B-2: Products Program Strategies

Program Strategies and Market Actors Targeted		Program Type & Administrator			
		Products Programs			
		Efficiency VT (Appliances)***	NYSERDA (Products)*****	NEEA (TV)*	NEEA (Clothes Washers)**
		Strategy Used? ●=strategies that appear to be more central to the program ○=strategies that appear to be less central to the program (○)=strategy was reduced or dropped as the program evolved			
Upstream Market Actors Targeted					
Market actors targeted:	Manufacturers				
Manufacturers					
Strategies	Manufacturer incentives Program awareness building, communications, and relationship building Account management for Up- and Mid-stream Program Program Website Coordinate with industry on national specifications/standards ENERGY STAR Brand recognition effort	●	○	○	● ○
Distributors					
Strategies	Coordinate with industry on national specifications/standards Recruitment and partnership building Program Website	●	○	●	
Midstream Market Actors Targeted					
Retailers					
Strategies	General incentive to allow retailers to place incentive where most effective (Spiffs, reserve more shelf space, etc.) Spiffs to retailers/dealers per sale Markdowns Market share incentives Program awareness building, communications, and relationship building Field support and training Account management for Up- and Mid-stream Program Merchandising support ENERGY STAR Brand recognition effort Provide program-approved product list Cooperative advertising POP materials Program Website In-store demonstrations/videos Data management, analysis and reporting Review sales and related data Field assessments performed on training, POP use Develop annual Program Initiative specifications	● ● ● ● ● ○ ●	● ● ● ● ● ○ ● ● ● ○ ○	○	● ● ● ●
Downstream Market Actors Targeted					
End-users					
Strategies	Rebates Coupons Program Website Targeting by cooperative advertising Provide program-approved product list Develop annual Program Initiative specifications ENERGY STAR Brand recognition effort In-store demonstrations/videos	○ ○ ●	○ ●	○	(○)
Other Market Actors Targeted					
Utilities					
Strategies	Coordinate with industry on national specifications/standards			●	●
EPA					
Strategies	Coordinate with industry on national specifications/standards ENERGY STAR Brand recognition effort	●		●	●

*Strategies mentioned in 2013 report
 **Strategies mentioned in 2001, 2004, and 2007 reports
 ***Strategies mentioned in 2002 and 2005 reports
 ****Strategies mentioned in 2013 report
 *****Strategies mentioned in 2012 report

Table B-3: Whole House Program Strategies

Program Strategies and Market Actors Targeted		Program Type & Administrator	
		Whole House	
		Efficiency VT*	NYSERDA **
		Strategy Used? ●=strategies that appear to be more central to the program ○=strategies that appear to be less central to the program (○)=strategy was reduced or dropped as the program evolved	
Midstream Market Actors Targeted			
Contractors			
Strategies	Participation incentives	(○)	
	Data reporting incentives	●	
	Buydowns	●	
	Sales and business training	●	
	Program training	●	●
	Certification/training	●	
	Equipment agreement		○
	Marketing support	●	
Cooperative advertising		●	
Auditors			
Strategy	Audit training	●	
Downstream Market Actors Targeted			
End-users			
Strategies	Financing		●
	Incentives for recommended installations	●	
	Low-cost audits		●
	Targeted by cooperative advertising		●
Other Market Actors Targeted			
Utilities			
Strategies	Coordination with Utility Programs	○	
Trade Associations			
	Coordination with Trade Associations	○	

*Strategies mentioned in 2013 report

**Strategies mentioned in 2010 report

Table B-4: New Construction Program Strategies

Program Strategies and Market Actors Targeted		Program Type & Administrator		
		New Construction		
		Efficiency VT**	NYSERDA***	NEEA*
		Strategy Used? ●=strategies that appear to be more central to the program ○=strategies that appear to be less central to the program (○)=strategy was reduced or dropped as the program evolved		
Upstream Market Actors Targeted				
Manufacturers				
Strategy	Develop and maintain specifications/standards			●
Distributors				
Strategies	Assistance with events/tradeshows Develop and maintain specifications/standards		○	●
Midstream Market Actors Targeted				
Builders				
Strategies	Builder incentives Subsidize energy ratings through builders Cooperative advertising incentives Mass marketing (PSAs, etc.) Assistance with events/tradeshows Tax credit education Training Training materials Installation QA and QC De-listing and de-rating of partners whose work does not meet program standards	● ● ○ ●	● ● ● ○ ○ ● ● ● ○	● ● ●
Contractors				
Strategies	Assistance with events/tradeshows Tax credit education Installation QA and QC De-listing and de-rating of partners whose work does not meet program standards	●	○ ○ ● ○	●
Energy Raters				
Strategies	Incentive for Energy Rater Training Program De-listing and de-rating of partners whose work does not meet program standards		● ○	
Real Estate Professionals				
Strategies	Mass marketing (PSAs, etc.) Training		● ●	● ●
Verifiers				
Strategies	Training			○
Appraisers				
Strategies	Training		●	●
Municipalities				
Strategies	Training		○	
Downstream Market Actors Targeted				
End-users				
Strategies	Rebates for equipment installed Program technical assistance Public relations activities Grassroots efforts Mass marketing (PSAs, etc.) Customer inquiry call center Tax credit education	○ ○	○ ○ ○ ○ ○	○ ●
Other Market Actors Targeted				
Utilities				
Strategies	Develop and maintain specifications/standards Engage and support utilities			● ○
EPA				
Strategies	Develop and maintain specifications/standards			●

*Strategies mentioned in 2012 report
 **Strategies mentioned in 2013 report
 ***Strategies mentioned in 2010 report

Table B-5: HVAC Program Strategies

Program Strategies and Market Actors Targeted		Program Type & Administrator	
		HVAC	
		NYSERDA (HVAC)**	NEEA (DHP)*
		Strategy Used? ●=strategies that appear to be more central to the program ○=strategies that appear to be less central to the program (○)=strategy was reduced or dropped as the program evolved	
Upstream Market Actors Targeted			
Manufacturers/Manufacturer Reps			
Strategies	Product buydowns	●	
	Outreach to supply chain about need for increased supply of EE products	●	
	Recruit, engage, develop partnerships with market actors	●	●
	Enable/instruct supply chain to help increase end-user awareness and demand	○	
	Cooperative marketing	●	
	Develop specification/standard		●
	Assistance with events/trade shows	○	
Distributors			
Strategies	Product buydowns	●	
	Outreach to supply chain about need for increased supply of EE products	●	
	Recruit, engage, develop partnerships with market actors	●	○
	Enable/instruct supply chain to help increase end-user awareness and demand	○	
	Cooperative marketing	●	
	Develop specification/standard		●
	Assistance with events/trade shows	○	
	In-store marketing		○
Midstream Market Actors Targeted			
Retailers			
Strategies	In-store marketing		●
Contractors			
	Recruit, engage, develop partnerships with market actors		●
	Product installation support		●
	Mass advertising (radio, TV, social media)		●
	Installation QA		●
Downstream Market Actors Targeted			
End-users			
Strategies	Product installation support		●
	Mass advertising (radio, TV, social media)		●
	In-store marketing		○
	Installation QA		●
Other Market Actors Targeted			
Utilities			
Strategies	Develop specification/standard		●
	Engage and support utilities		●
EPA			
	Develop specification/standard		●

*Strategies mentioned in 2012 report

**Strategies mentioned in 2011 report

B.2 Market Barriers by Program Type

NMR found the following market barriers identified across the programs we reviewed.

Table B-6: Residential Lighting Barriers

Barrier Type & Barrier	Year Most Recently Identified
Financial	
Higher initial cost of energy-efficient product or service	2008
Market actor priorities	
General disinterest in bulbs and rebates at the corporate level	2002
Lack of market infrastructure	
Lack of product diversity to meet needs and style preference	2008
Lack of product availability	2008
Limited manufacturers	2008
Limited amount of showroom space	2002
Perceived lack of national market/profit potential	2002
Lack of support for energy-efficient lighting products	2002
Target audience awareness	
Lack of awareness of benefits of energy-efficient lighting	2008
Low consumer familiarity with products	2008
Quality/performance concerns	
Product quality	2008
Various technical issues (e.g., dimmability, slowness to brighten, etc)	2008
Product or service drawbacks	
Low satisfaction with light quality and color	2008
Mercury content	2008
Technology	
Fixtures do not sell as quickly as bulbs	2008
Pin-based technology so bulb replacement not as easy	2008

Table B-7: Products Barriers

Barrier Type & Barrier	Year Most Recently Identified
Financial	
Higher initial cost of energy-efficient product or service	2010
Split incentives (rental units)	2010
Target audience awareness	
Inadequate marketing and promotional materials	2010
Language barriers (English not primary language)	2010
Lack of awareness of energy-efficient product	2010
Lack of information and awareness among upstream market actors regarding the benefits and business opportunities for energy-efficient products and services	2010
Consumer knowledge/understanding	
Lack of reliable information on energy-efficient practices in existing homes	2010
Information costs associated with understanding features of energy-efficient products and associated benefits	2010
Lack of consumer understanding of life-cycle costing	2010
Confusion due to increased efficiency promotional efforts from multiple sources	2010
Confusion regarding how to qualify or take advantage of opportunities associated with state and federal tax incentives	2010
Consumer trust	
Lack of trust in residential contractors or salespersons	2010
Perceived lack of demand	
Perceptions of lack of demand for energy efficiency and renewable options	2010
Lack of market infrastructure	
Lack of an easy way for consumers to identify most efficient TVs	2012
Greater competition for partnering with market actors to accomplish goals of a diverse variety of efficiency programs and organizations.	2010
Lack of availability of some high efficiency products/models	2010
Lack of replacement equipment for new technologies	2010
Contractors unwilling to learn and conduct services outside of their specific trade	2010
Limited availability of subcontractors with training and experience	2010
Lack of energy-efficiency training opportunities available in local community	2010
Lack of time and income for attending training and certification exams	2010
Market lacks experience in determining the best way to create a profitable business model for long-term	2010
Lack of policies amenable to energy efficiency and renewables	2010
Lack of available real-time pricing and other load management options	2010
Finite amount of showroom space constrains the number of models that can be stocked	2002
Federal Standards process uncertain	2001
Limited competition	2001
Market actor priorities	
Energy-efficient TVs not being prioritized by retailers, manufacturers and consumers	2012
Resistance to change	
Programs may need to be national in scope to convince TV brands to incorporate the measure	2011
Resistance to new and/or innovative technologies	2010
Resistance to changing contractors or making demands upon their contractors	2010
Quality/performance concerns	
Performance uncertainties/Concern regarding product quality	2010
Product or service drawbacks	
High efficiency model size and detergent requirements	2004
Technology	
TV feature sets change quickly and with every new product model	2011
Other external influences	
Rules and procedures by housing regulators (e.g. , HUD, DCHR) that hinder prompt design and installation of improvements	2010
Policies of other low-income programs	2010

Table B-8: Whole House Barriers

Barrier Type & Barrier	Year Most Recently Identified
Financial	
The initial cost of an audit	2013
How to pay for the projects	2013
Lack of money to pay for energy-efficiency investments by low- to moderate-income households.	2010
Consumer awareness	
Lack of awareness of the benefits of energy efficiency-investments for bill savings and increased comfort, health and safety	2010
Consumer knowledge/understanding	
Confusion regarding overlapping programs offerings	
Confusion regarding how to qualify or take advantage of opportunities associated with state and federal tax incentives	
Consumer attitudes	
The independent nature of local consumers - many are Do-it-Yourselfers	2013
Household confidence that the estimated savings are real	2013
Consumer trust	
Lack of trust in residential contractors	2010
Lack of market infrastructure	
Contractors are not trained in selling whole-house energy-efficiency upgrades	2013
Lack of availability of high-efficiency equipment	2010
Lack of repair parts for efficient equipment and new energy technologies	2010
Contractors often unwilling to learn about/conduct services outside of their specific trade	2010
Lack of eligible contractors (including skilled specialty contractors)	2010
Cost for completing training and BPI certification	2010
Uncertainty of whether investment in BPI certification will pay off	2010
Lack of real time prices for electricity	2010
Perceived lack of demand	
Perceptions of lack of demand for energy efficiency and renewable options	2010

Table B-9: New Construction Barriers

Barrier Type & Barrier	Year Most Recently Identified
Financial	
It is cheaper to build a house that is not to code than to build one that is at or above code (and some builders do this)	2013
It costs more for builders to build ENERGY STAR Homes	2013
Split incentives (builders make efficiency decisions but don't pay the energy bills)	2012
Additional costs associated with buying an ENERGY STAR home	2010
Homebuyer priorities	
Energy efficiency is not a priority for home buyers	2010
Hassle/effort	
It requires more hassle/effort for builders to build ENERGY STAR Homes	2009
Lack of market infrastructure	
Lack of an easy way to identify and compare efficient homes	2012
Limited technical skills by builders/subcontractors	2012
Lack of availability of ENERGY STAR Homes	2010
Lack of consumer information on energy efficiency in new construction	2010
Builders lack experience building ENERGY STAR Homes	2010
Builders lack experience in selling ENERGY STAR Homes	2010
Lack of high efficiency equipment and parts for repair	2010
Lack of trained technicians to fix and maintain the equipment	2010
Geographically dispersed supply of qualified HERS raters	2010
Lack of real time prices for electricity	2010
Limited market actor experience with lighting design and energy-efficient residential lighting	2002
Lack of energy codes governing residential lighting	2002
Target audience awareness	
Lack of awareness among market actors on energy savings and on non-energy benefits	2012
Lack of awareness of ENERGY STAR Homes	2010
Perceived lack of demand	
Perceptions of a lack of demand for energy efficiency and new energy technologies	2010
Lack of demand for HERS raters by builders suggests this is not a profitable occupation	2010
Consumer trust	
Reduced confidence in ENERGY STAR label due to report of misuse in media	2010
Value of energy efficiency not appreciated	
Builders doubt building high efficiency homes will increase sales price or be cost-effective	2012
Appraisers/mortgage lenders don't appreciate value of energy-efficient homes	2012
Builders perceive that customers are interested in energy efficiency but aren't willing to pay more for it	2009

Table B-10: HVAC Barriers

Barrier Type & Barrier	Year Most Recently Identified
Financial	
Higher initial cost of energy-efficient product or service	2012
Purchase costs that are too high for many consumers (particularly in the poor economy)	2012
Market downturn (less money for rehabs)	2010
Cost-sensitivity among occupants of manufactured homes	2010
Split incentives (multifamily)	2010
Target audience awareness	
Lack of marketing	2012
Lack of awareness of benefits of energy-efficient and renewable-energy equipment by public	2011
Low consumer familiarity with technology	2010
Lack of market infrastructure	
Lack of product infrastructure	2012
Marketplace acceptance/installer resistance (don't think they work well in colder regions, etc.)	2012
Lack of trained installer base	2012
Contractor resistance to selling best equipment	2011
Few training opportunities (installers)	2010
Weak distribution networks	2010
Aesthetics	
Appearance of equipment/aesthetics	2012
Product or service drawbacks	
Inappropriate for some applications (e.g., tight new homes)	2010