Action Plan for Measuring Market Effects

This document explains how to measure the market effects of energy-efficiency programs and how to design programs that generate market effects.

What are market effects? Market effects are sustained increases in the adoption and penetration of energy-efficient technologies and practices that result from structural changes in the market and in behaviors of market actors that are induced by a market intervention. When a program (the market intervention) has market effects, it affects the market as a whole, not just the program participants. For example, a program that motivates retailers, distributors, or manufacturers to offer a wider variety of efficient equipment increases efficient choices for all buyers and can reduce prices of efficient equipment for all buyers. Likewise, a program that provides information about a home's energy efficiency at the time of a real estate transaction could influence both buyers and sellers in the real estate market, as well as other actors in the market, such as builders.

What programs generate market effects? Not every energy-efficiency program generates market effects. Those most likely to generate market effects are usually *designed* to influence the entire market. For example, upstream programs may generate market effects if they are designed to influence manufacturers, distributors, and installers who will in turn influence *all* of their customers. Another example of programs that generate market effects are those designed to provide education or information to change practices or decision-making among market actors.

Why measure market effects? Market effects can be difficult to measure because their reach goes far beyond program participants. However, the cumulative impact of influencing the entire market may be large and sustained over time, which means that advance planning is required to capture key changes from the beginning. For this reason, when market effects are likely to be substantial, it is worth trying to measure them. Measurement should start as early as possible, so that the full savings generated by the program can be claimed.

How do programs measure market effects? Measuring market effects takes preparation. It is important for implementers and evaluators to work together to follow these steps:

1. Identify appropriate target markets
2. Characterize the market and identify the baseline
3. Develop a program theory and indicators of market effects
4. Decide on a method for measuring net savings (there are four methods to choose from)
5. Collect and analyze required data to quantify net savings

The remainder of this document provides more information on these steps, as well as information on different types of programs that can generate market effects.[i]

There are two categories of energy-efficiency programs deployed in the United States: **resource acquisition** and **market transformation**. While both can generate market effects, these programs tend to have different degrees of influence on markets. Resource acquisition programs are those designed with the intention of "purchasing" energy savings in the public interest. They do not necessarily produce lasting changes in markets, although market effects can be an important side effect of such programs. (The energy-efficiency programs deployed by Mass Save are resource acquisition programs.) Targeted market transformation programs are explicitly designed to induce market effects that result in lasting market transformation. Part I of this guidance focuses on maximizing the likelihood of achieving market effects from resource acquisition programs and quantifying the results. Part II describes the differences between resource acquisition and market transformation programs, and the evaluation of market effects from the latter, in more detail.

PART I: HOW TO MEASURE MARKET EFFECTS

This section walks through the steps that energy-efficiency program administrators (PAs) need to take to be able to claim savings for the market effects of their resource acquisition programs.

STEP 1: IDENTIFY APPROPRIATE TARGET MARKETS

The first step in the process is to determine what specific markets are good candidates for measuring market effects. The "market" in "market effects" refers to the system of demand and supply for a product or service, including the "market actors" involved in producing, selling, and consuming the product or service. The market should be definable and not too broad. (For example, commercial high-bay lighting or residential single-family new construction are definable markets that are not too broad. By comparison, C&I custom measures would be too disparate – and thus too broad – to be a single market. A measure from a single manufacturer would be too narrow.)

Not every resource acquisition program that targets a particular market will generate enough market effects for evaluators to be able to detect them above the "noise" of other influences on the market. Below are two key questions to consider:

1. *Is the program relatively new or not yet begun?*

   Successfully measuring market effects requires planning the evaluation much further in advance than for most other types of energy-efficiency program evaluation. This means involving evaluation staff in the program planning process to ensure that the right data are collected for measuring market effects, ideally beginning before the program launches or very close to its launch.

   If the program is new or not even started, it is more likely that market effects will be substantial enough to warrant the cost of measurement. This is because it will be possible to measure the baselines for market effects before the effects have begun to accumulate. If the program is already well established when the market effects baselines are measured, it will be more difficult to identify the market effects the program has already caused as it is very difficult to gather accurate information on market conditions retrospectively. In general, PAs should expect to measure market effects from the current time forward, and not expect to be able to measure or claim market effects that occurred in the past if no plan was previously in place to measure them.

2. *Is the program likely to generate substantial market effects?* Programs are most likely to generate sufficient market effects to be worth measuring when they meet one or more of the following conditions:

   - The savings per transaction are small – but there are a lot of transactions
   - There are significant failures in the market for the product or service. For example, there is not enough information available in the market about the product or service, there isn't enough competition for the product or service, or a market for the product or service doesn't yet exist.
   - A significant portion of the actors in a market will be touched by the program
   - The product or service offers significant non-energy benefits, such as increased comfort, increased home value, or reduced maintenance
   - The program relies on strategies that are more likely to change the whole market than to just change participants. Examples are provided below.
     - The program leverages market forces to achieve program goals. For example, programs focused on influencing "upstream" or "midstream" market actors, such as manufacturers, distributors, or installers, who can in in turn influence all buyers in a market.
     - The program provides education or information to change practices or decision-making among market actors.
     - Market actors share risks with the program. Examples include market actors bearing part of the cost of program-supported advertising for equipment on which the market actors receive incentives, funding promotional displays, and paying for the time of their sales staff attending program-supplied training.

Examples of markets that are not good candidates include those with split incentives, very complex markets, and markets without good leverage points or allies to work with.

STEP 2: CHARACTERIZE THE MARKET AND IDENTIFY THE BASELINE

In order to measure market effects, it is important to understand who the market actors are, how the market actors work together, and the current conditions of the market. A **market characterization study** can provide this information by examining the entire supply chain for the equipment and services in question and the categories of market actors who may be influenced by the initiative. A market characterization study should describe the following:

- Who influences whom;
- How profits are made;
- Where value is added in the market;
- How pricing is set; and
- The barriers to efficiency and potential leverage points.

The market characterization study should include a market model diagram, which is a graphic depiction of the market actors and of flows of equipment or services and their influence in the target market. Appendix A provides an example of a market model diagram. Since markets change, planners and evaluators should expect to characterize the target market multiple times over the life of a program that is designed to maximize market effects.

It is important to have a good understanding of the state of the market as early as possible in the life of any program that is expected to generate market effects since this will provide confidence in attributing market effects from the program going forward. For this, a **baseline** needs to be measured. Ideally, the initial baseline should describe market conditions before the program intervenes in the market. If a program already exists, but will be modified to maximize market effects, then the baseline should describe market conditions before changes are made to the program or very early in their implementation.

STEP 3: DEVELOP A PROGRAM THEORY AND INDICATORS OF MARKET EFFECTS

In order to measure market effects, it is essential to have a well-defined theory of how and why the program is expected to change the market from baseline conditions to the desired conditions. It works best to develop this theory during program design and planning, and to include both program implementation and evaluation staff in the process.

The **program theory** describes how the program's activities are expected to cause changes among target audiences or market actors that will lead to changes in the market. The purpose of the program theory is to clearly identify the program's causal hypotheses (i.e., how a particular activity or set of activities is expected to cause a particular outcome), and to highlight any assumptions that are embedded in the program design. Program planners should refer to the market model developed in Step 2 to identify gaps in the market and explore how program interventions may change the market.

The program theory is usually depicted as a **logic model**, accompanied by indicators of program activities and outcomes, including market effects. A logic model is a graphic version of the program theory. It should illustrate how the program activities will result in short-term and long-term responses among market actors and how the market will change over time as a result. A logic model that is actionable for evaluation should include the following five elements:

1. The resources and partners the program will bring to the table or will leverage
2. The activities the program will undertake
3. The short-term "outputs" from these activities – that is, the direct consequences of the activities
4. The audience(s) the program targets
5. The outcomes – that is, changes in decision-making and behaviors and ultimately to the market – expected from the program activities and outputs, organized by time (short-, intermediate-, and long-term)

The logic model can also be helpful in identifying feedback loops and interconnections among different components of the program. Examples of logic models are included in Appendix A. Showing the program theory as a logic model helps to tell the program's story and increases the likelihood of identifying all the types of market effects it could generate and the indicators that can reasonably be used to measure them.

Program planners also need to identify **indicators** to measure the outputs directly from the program activities and the less direct outcomes expected to result from the activities and outputs. Some of the outcome indicators will also be indicators of market effects. Examples of program indicators, including outputs and outcomes, are included in Appendix A.

The outcome indicators are almost always much more challenging to measure than the program output indicators since the latter are typically generated by the implementation team as part of the program but the former must be collected or purchased. It is important to consider the outcome indicators with care as they are often expensive to measure or purchase if available, difficult to obtain, or both.

Not every indicator needs a baseline. Sales indicators and other indicators that will be used to establish attribution should be measured early in the life of a program to establish a baseline. Indicators that will be used in determining when it is time to change the program approach or efficiency requirements may not need a baseline.

Ideally, program planners and evaluators will work together to identify appropriate, measurable indicators of program activities, outcomes, and market effects as part of program planning. By planning for evaluation and the program simultaneously, program planners increase the likelihood that when the time comes for compiling evaluation results and assessing impacts, there will be data available to show that some part of the market changes evaluators measure can be attributed to the program.

STEP 4: DECIDE ON A METHOD FOR MEASURING SAVINGS

The program theory and indicators of market effects set the stage for evaluation. Building on this information, evaluators can design an approach for gathering information to measure the market effects that actually occur as the program is implemented. Measuring and claiming savings from market effects requires quantifying the magnitude of the market changes induced by the program. Sales data analysis methods, working with sales data of sufficient specificity and coverage, can largely capture the total net effect of the program. These methods require market share or market penetration data.

While cross-sectional analysis is commonly used in measuring savings from market effects, it is not the only method available. Evaluators use one or more of four general methods for estimating savings stemming from the market effects of a program.

1. Supply-side market actor self-reported counterfactual analysis
2. Cross-sectional analysis, which may include time-series data
3. Forecasting or retrocasting the non-intervention baseline
4. Structured expert judgment

All these approaches require each of the following:

- Estimations of the size of the market both for efficient and non-efficient measures (a.k.a. market share or market penetration) in the baseline period before the program is implemented and at the time of evaluation
- Identification of changes in market actor behavior
- Measurement of savings achieved at the market level
- Estimation of the baseline for savings (a.k.a. “naturally occurring savings” or the counterfactual), which is the savings that would have occurred in the absence of the program

The choice of savings approach will be affected by factors such as the availability of market share or market penetration data; the degree to which the market for the product, equipment, or service is already transformed; and the availability of appropriate non-program areas for comparison and degree to which they have been influenced by other areas' programs. ("Market share" and "market penetration" both refer to the ratio of sales of high-efficiency equipment to all sales of this type of equipment.)

STEP 5: COLLECT AND ANALYZE REQUIRED DATA TO QUANTIFY SAVINGS

Measuring savings from market effects is most likely to be successful when programs consider tracking and measuring market share or penetration as part of program planning, begin this tracking early in the program, and to continue it throughout the life of the program. However, it is often extremely challenging to obtain market share data. Comprehensive sales or shipment tracking systems have never been available for most markets. Although this problem can be reduced to some extent by requiring participating market actors, such as suppliers and retailers, to provide sales data for research purposes, currently programs rarely require this. Absent such comprehensive sales data, there are other ways to obtain a general picture of sales or purchases of efficient and standard equipment. These include requesting self-reported state- or market-level sales or shipment data from vendors, contractors, or distributors; extrapolating estimates from participating end-users' purchases; or sending trained technicians to collect on-site data from a sample of buildings.

Market Effects Savings Measurement Examples

Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs (2014) recommends taking a market-focused approach to measuring NTG in order to capture market effects. As this work explains, because it focuses on the market, not the program, a market-focused approach to measuring NTG tends to capture more savings from market effects than the participant-focused approach. Also, since in the market-focused approach market effects and spillover are calculated together, it avoids the double-counting problem inherent in adding a market effects savings estimate to a traditional net savings estimate. The generic market-focused NTG equation is:

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

Table 1 lists examples of studies that quantified market effects using the approaches listed in Step 4. After the table is a brief description of how the approach was implemented in each study. Two of the four approaches quantified market effects as part of market-focused NTG, while two quantified market effects without measuring NTG.

Table 1: Examples of Measuring Savings

Measurement Approach	Market Effects of the Better Buildings Neighborhood Program Study (US DOE, 2015)	Multistage Lighting Net-to-Gross Assessment (MA, 2015)	ConEdison Retail Products Platform Evaluation (NY, 2018)	Residential New Construction & CCSI Attribution Assessment (MA, 2018)
Supply-side market actor self-reported counterfactual analysis	X			
Cross-sectional analysis, which may include time-series data		X		
Forecasting or retrocasting the non-intervention baseline			X	
Structured expert judgment				X

Supply-side Market Actor Self-Reported Counterfactual Analysis

The *Market Effects of the Better Buildings Neighborhood Program study (2015)* used the counterfactual method to quantify market effects and estimate the resulting energy savings from the U.S. Department of Energy's Better Buildings Neighborhood Program (BBNP). This program provided state and local governments with grants and worked with nonprofits, building energy-efficiency experts, contractor trade associations, financial institutions, utilities, and other organizations to develop community-based programs, incentives, and financing options for comprehensive energy-saving upgrades.

The study team developed a logic model to identify likely market effects, which in this case were changes in the delivery channels, institutional supports for, and demand for implementation of the technologies. The study team identified one or more indicators of progress toward each market effect and developed survey and interview questions designed to measure each indicator. The team fielded these questions to survey samples of participating contractors, nonparticipating contractors, and distributors working in the service territories of sampled grantees. The team also surveyed participant and nonparticipant homeowners in areas served by all grantees, and conducted in-depth interviews with financial partners of grantees, such as credit unions and banks. In addition to asking each group questions to assess progress on the indicators relevant for the group, the study team asked participating and nonparticipating contractors to estimate the impacts of BBNP on the number of upgrades they completed. Across multiple indicators and from multiple data sources the team found evidence of local market effects influenced by BBNP, such as increased activity in the energy-efficiency upgrade market; increased adoption of energy-efficient building and business practices, as well as sales of energy-efficient equipment; increased marketing of energy efficiency; and increased availability of financing. By comparing the self-reported results from each set of groups, the team estimated that BBNP had resulted in a net

increase in upgrades. The team then developed an estimate of the savings associated with the upgrades attributable to BBNP.

Cross-Sectional Analysis

The 2015 *Massachusetts Multistage Lighting Net-to-Gross Assessment* used a cross-sectional analysis approach that compared both self-reported purchases by home-owners in Massachusetts and residential lighting saturation against other states that served as control areas. This resulted in the program's effects on the Massachusetts residential lighting market being included in the NTG measurement.

The control states (GA, KS, and NY) were meant to stand in for the Massachusetts lighting market in the absence of the program. The self-reported purchases approach to estimating NTG ratios required three inputs:

- Market-level CFL and LED purchases in MA;
- Market-level CFL and LED purchases in the comparison area(s);
- Program-supported CFL and LED sales in MA.

The Team obtained market-level purchases in MA and comparison areas through on-site visits to households in MA and the comparison states. During each on-site visit, the technician asked the homeowner when they had purchased each CFL or LED installed or in storage. These inputs were used in the following market-level NTG calculation:

$$NTG = \frac{(Massachusetts\ Market\ Sales - Comparison\ Area\ Market\ Sales)}{Massachusetts\ Residential\ Program\ Sales}$$

Because NYSERDA had ramped down of support for energy-efficient bulbs by the time of this study, the team also used saturation data from NY and MA to develop a second estimate of market-level NTG using the following equation:

$$NTG = \frac{MA\ market\ purchases\ 2013\ and\ 2014 - MA\ market\ purchases\ 2013\ and\ 2014\ assuming\ a\ similar\ change\ in\ Saturation\ and\ Storage\ as\ in\ NY\ from\ 2013\ to\ 2015}{MA\ Program\ Sales\ 2013\ \&\ 2014}$$

Both sets of NTG measurements were retrospective. The study rectified the different retrospective market-level NTG values and developed prospective market-level NTG values based on them, through a consensus process.

Forecasting or Retrocasting the Non-intervention Baseline

The ENERGY STAR Retail Products Platform (ESRPP) Program uses a nationally-coordinated midstream design aimed at influencing retailers to (1) alter the assortment of models they offer for sale, and to (2) sell, promote, and demand more energy-efficient models of home appliances and consumer electronics. To assess the impact of its Retail Products Platform, the *Con Edison Retail Products Platform (RPP) Evaluation* study estimated changes in unit sales for RPP product groups by modeling sales in the pre-program period, using the model to predict sales during the program period, and then comparing the predictions to the observed sales.

The data used as inputs for the models were gathered through two methods. The first was in-depth interviews with retail merchants responsible for retailer purchasing decisions, marketing staff, and sustainability specialists from three large retail chains. The second was shelf assortment surveys (i.e., in-store visits conducted at a sample of participating retailer stores to gather data on product assortments). The shelf assortment surveys conducted twice each year to allow for comparisons within each product category over time.

With these data, the study team developed three statistical models of baseline sales behavior that predicted future sales. These models incorporated different assumptions about how the program would affect qualified product sales and how the baseline sales behavior would change. Each of the models allowed for "naturally occurring" pre-program trends in sales or market share.

1. A *sales model* used monthly sales values, assuming that the effect of the program was to increase the sales of program-qualified products. This model allowed qualified and non-qualified sales to vary separately.
2. A *market share model* used monthly penetration rates, assuming that the effect of the program was to increase the market share. This model combined the qualified and nonqualified model sales and relied on changes in the ratio over time.
3. A *probit model* used a transformation of the market share used in the market share model. It was based on an assumption that the effect of the program would have a smaller absolute impact on the market share if the market share is either very small or very large, but a larger absolute impact if the market share was modest.

The study team estimated energy savings from RPP in two parts: the increases in sales attributable to the program, and average savings for qualified products by product group. To more robustly estimate changes in sales of qualified products than a single model could offer, the study team used a model-averaging approach that combined estimates from the three models to account for uncertainty in the true market behavior. The team then estimated per-unit energy savings for each product group based on the average energy savings of qualified products in the program period.

As part of this study, the study team also validated the activities, outputs, outcomes, and linkages in the program logic model to assess program performance and make plausible estimates of attribution.

Structured Expert Judgment

The *Massachusetts Residential New Construction and CCSI Attribution Assessment* (2018) study used a Delphi panel approach to develop retrospective and prospective estimates of the effects of two Massachusetts residential new construction efforts by the MA PAs on single-family new construction building practices across the Massachusetts residential new homes market. These were the low-rise Residential New Construction (RNC) program and the residential portion of the Code Compliance Support Initiative (CCSI).. The market effects were captured as non-participant spillover in a market-level NTG ratio:

$$Net.to.Gross\ Ratio = 1 - Free\ Ridership + Non.Participant\ Spillover$$

The Delphi method is an interactive and iterative approach that leverages a panel of experts to develop a group judgement using a series of structured questionnaires. It is based on the principle

that structured, closed-ended responses from experts, informed by the responses from their peers, may lead to more accurate results than unstructured responses without the benefit of iterative feedback.[ii] The Delphi panel primarily comprised building efficiency consultants working in and outside of Massachusetts and code officials working in Massachusetts. The team asked panelists to first estimate the counterfactual (i.e., how building practices would have changed and what measure-level efficiencies would have been for single-family homes that were completed in 2015 had the RNC program ceased to exist after 2011 and had the CCSI never been implemented). The team then developed models to calculate the difference in energy consumption from program and non-program homes as they were constructed (the as-built scenario) and as panelists suggested they would appear in the absence of the programs (the counterfactual scenario). The team analyzed the as-built and counterfactual energy consumption to calculate retrospective savings estimates and NTG estimates including market effects.

PART II: TYPES OF PROGRAMS THAT CAN GENERATE MARKET EFFECTS

There are two categories of energy-efficiency programs deployed in the United States: **resource acquisition programs** and **market transformation programs**, and these programs tend to have different degrees of influence on market effects.

Resource acquisition programs are those designed with the intention of "purchasing" energy savings in the public interest. The savings goals of resource acquisition programs are short-term (e.g., within three years) and met through financial incentives or technical assistance to end-use customers. The savings resulting from these programs happen relatively fast and confidence in the savings is high. Resource acquisition programs do not necessarily produce lasting changes in markets, although market effects can be an important side effect of resource acquisition programs. The energy-efficiency programs deployed by Mass Save are resource acquisition programs.

In contrast, targeted **market transformation programs** or initiatives use interventions in selected markets with leverage points expected to yield to market transformation, with systematic but flexible long-term strategies for influencing those leverage points. Targeted market transformation initiatives are explicitly designed to induce market effects. Compared to resource acquisition programs, the results are relatively slow, typically taking from two years to a decade. Market transformation initiatives are most commonly implemented by non-utility program administrators in states with explicit policy support for market transformation, such as the Pacific Northwest states, New York, and Vermont. Massachusetts does not currently offer explicit policy support for market transformation. The Appendix provides information on policy approaches that can support market transformation programs where they operate alongside resource acquisition programs.

Table 2 summarizes the differences between resource acquisition and market transformation, including program scale, the level at which the programs target their marketing, program goals, the underlying program approach, the time frame over which results should accrue, and tracking, measurement and evaluation.

Table 2: Distinctions between Resource Acquisition Programs and Market Transformation Initiatives[iii]

	Resource Acquisition	Market Transformation
Scale	Program	Entire defined market
Target	Participants	All actors in the defined market
Goal	Near-term savings	Structural changes in the market leading to long-term savings
Approach	Save energy through customer participation	Save energy through mobilizing the market
Scope of Effort	Usually from a single program	Results from effects of multiple programs or interventions
Amount of Program Administrator's control	PAs can control the pace, scale, geographic location, and can identify participants in general	Markets are very dynamic, and the PAs are only one set of actors. If, how, where, and when the impacts occur are usually beyond the control of the program administrators.
What is tracked, measured, and evaluated	Energy use and savings, participants, and free-ridership; sometimes spillover	Interim and long-term indicators of market penetration and structural changes, attribution to the program, and cumulative energy impacts.
Timeframe for cost-effectiveness	Usually based on 1st year or cycle savings	Is usually planned over a five to ten-year timeframe

Source: Prahl, Ralph and Ken Keating. 2014. "Building a Policy Framework to Support Energy Efficiency Market Transformation in California." California Public Utilities Commission.

Tools of Market Transformation

The following program approaches are common to market transformation efforts, but can also be adopted by resource acquisition programs to increase the likelihood of generating market effects.

Recognize and use market forces and **use upstream market actors to influence downstream adoption**. Engage the market rather than individual end-users, working within the market structure. For example, to change customer decision-making, work indirectly with influential market actors such as manufacturers, distributors, builders, or installers. This often includes, but need not be limited to, encouraging downstream adoption by providing incentives to retailers' sales staff, distributors, installers, or other market actors. It can also include making structural changes to channel decision-making, such as encouraging plumbers who routinely carry storage water heaters for emergency replacements to ensure that the units they carry are high efficiency, or working to strengthen energy-efficiency standards.

Find market allies who are willing to work with the program. Take as an example a residential new construction program that relies on ENERGY STAR specifications: Some homebuilders build close to ENERGY STAR requirements even in the absence of a such a program. It is easier to get such builders to make a few tweaks to their practices so that the homes they build fully qualify to work with the program than it is to recruit and train builders who routinely build less efficient homes. While some of these builders may be free riders, they can contribute to the momentum

that down the line will draw in builders of less efficient homes. Another way to work with market allies is to get their input into program design.

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. Cooperative advertising, funding of promotional displays, and training of salespeople are examples of investments programs make that offset the risk for other market actors, but with uncertain outcomes for the programs. An example of risk sharing in the other direction is requiring market actor partners to fund promotional and educational activities of a value similar to the total value of the discounts the market actors expect to receive via the program.

Tie non-energy benefits to the product or service. Highlighting non-energy benefits can help tip the scales in favor of efficiency. Examples include emphasizing comfort and health in retrofit programs, or improved light quality and long measure life for LED lighting.

Leverage resource acquisition tools or programs. The scale of commitment required to move large and established markets means that programs may need to spend a great deal of money on a strategic market transformation effort while waiting years to reap the benefits. Given the need to show progress in the short term, too, strategic market transformation initiatives often include some characteristics of resource acquisition programs, such as incentives, or may work closely with such programs. Because market transformation initiatives target entire markets, when incentives are used they are typically offered to upstream or midstream market actors.

Focus on early adopters in opening markets for innovative energy-efficiency measures. The research on technology adoption suggests that if an initiative can get early adopters to embrace the energy-efficient measure 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.

Form a market-based advisory group to help shape and review the program. Solicit design input from market actors, either directly or through venues such as regional or national non-profit organizations that work on behalf of energy-efficiency programs.

Evaluating Market Transformation Initiatives

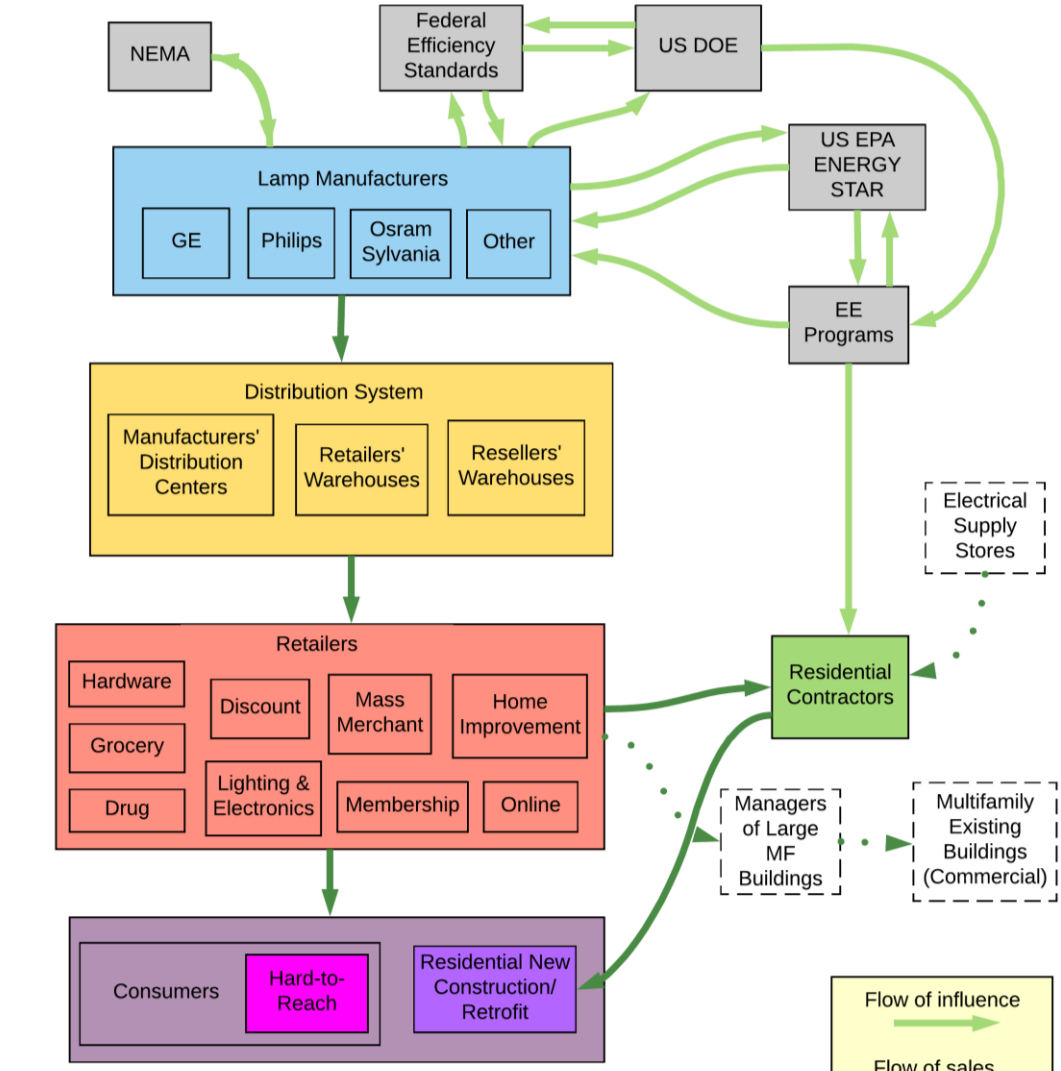
Steps 1 through 5 in Part I are the same for market transformation initiatives as for resource acquisition programs that aim to maximize market effects. However, for market transformation initiatives, evaluation should continue even after the initiative has ended, in the form of ongoing tracking of the market. The purpose is to assess the sustainability of the market effects without the intervention, and to identify backsliding or emerging opportunities that might warrant re-entering the market.

Appendix A

A.1 Example Market Model Diagram

Figure 1 is a market model for the Massachusetts residential lighting market. It displays the market actors in this market and depicts flows of influence and sales within the market.

Figure 1: MA Residential Upstream Lighting Market Model



Note: Observations from a recent commercial LED lighting study suggest the supply chain, particularly manufacturers, may differ substantially between LED and fluorescent lighting. This suggests future research into the supply chain for LED residential lighting may be warranted.

Adapted from DNV GL. 2014. *Final Report: Baseline Characterization Market Effects Study of Investor-Owned Utility Programs to Support LED Lighting in California.* June 14. CALMAC Study ID: CPU0074.01.
http://www.calmac.org/publications/2014%5FDNV%5FGL%5FLED%5FMarket%5FEffects%5FStudy%5FFinal.pdf
Informed by NMR Group. 2016. *2015-16 Lighting Market Assessment Consumer Survey and On-site Saturation Study.* August 8.
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and EMI. 2015. C17: Connecticut Commercial & Industrial (C&I) Market Research. August 28.
http://www.energizect.com/sites/default/files/CT%20C%26I%20Market%20Research%20%28C17%29%20Final%20Report%2C%208-28-15.pdf

A.1.1 Example Logic Models

Figure 1 and Figure 2 present the left and right halves of the logic model for the Massachusetts Residential Upstream Lighting Program.

Figure 2: MA Residential Upstream Lighting Program Logic Model – Left Half

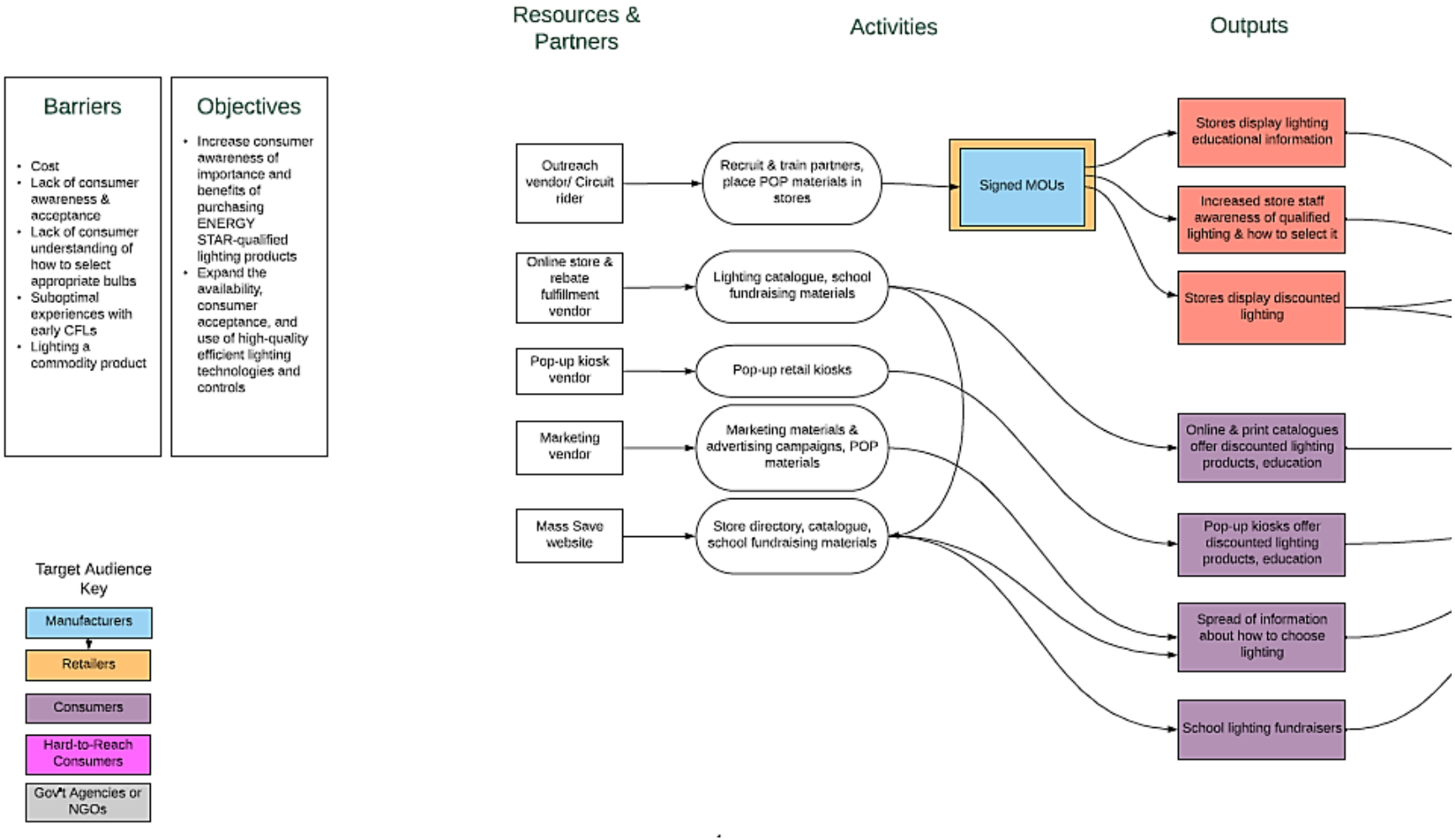
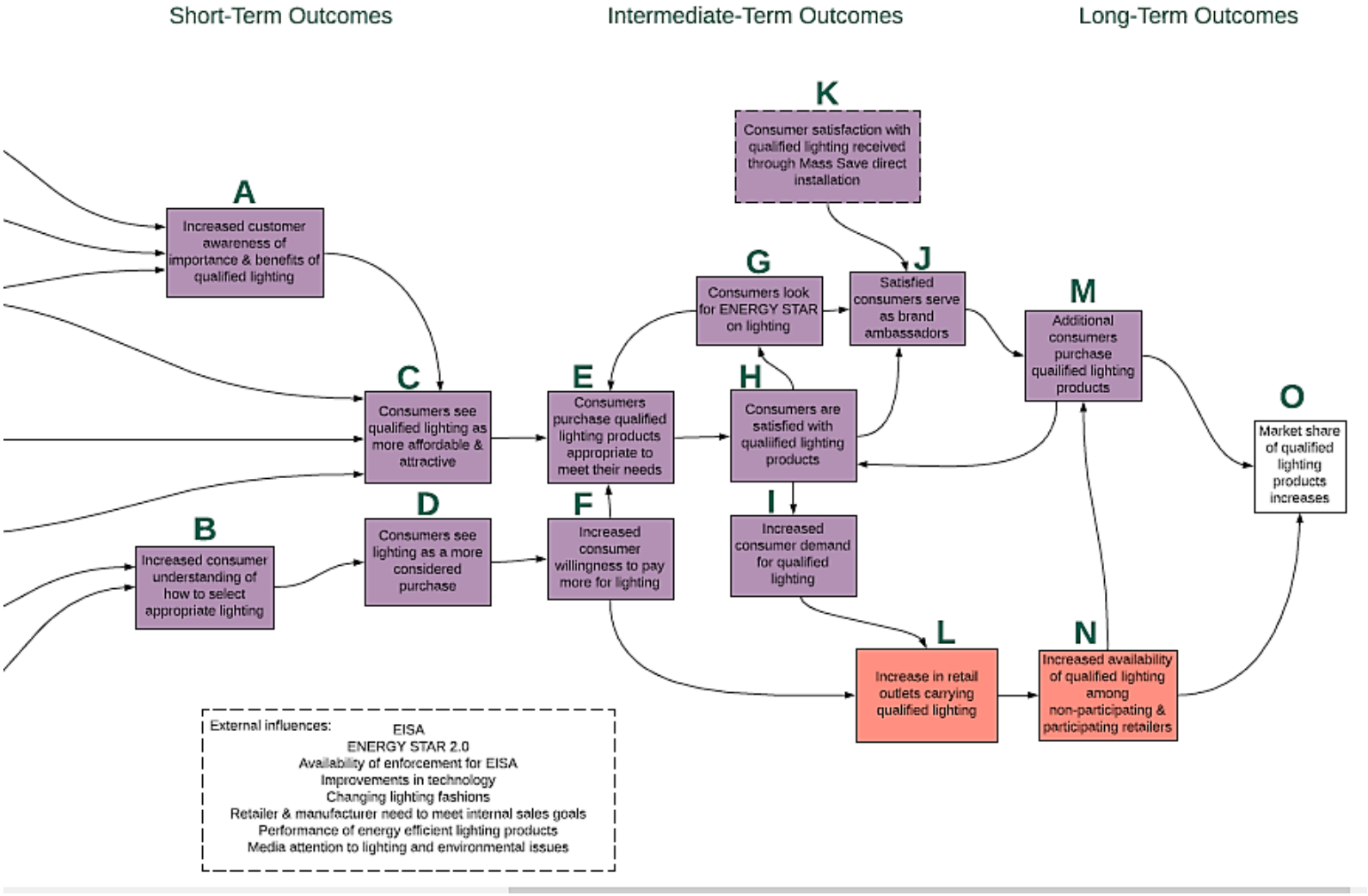


Figure 3: MA Residential Upstream Lighting Program Logic Model – Right Half



A.1.2 Example Program Indicators

Table 3, Table 4, and Table 5 list the short-, intermediate-, and long-term outcomes presented in Figure 3. Some of these outcomes are market effects. The bulleted items shown beneath many of these outcomes are indicators that can be used to measure progress towards these outcomes.

Table 3: Short-Term Outcomes and Indicators from MA Logic Model

Short-Term Outcomes	
A	Increased customer awareness of importance & benefits of qualified lighting
B	Increased customer understanding of how to select appropriate lighting
C	Consumers see qualified lighting as more affordable and attractive
	➢ LED Satisfaction
D	Consumers see lighting as a more considered purchase

Table 4: Intermediate-Term Outcomes and Indicators from MA Logic Model

Intermediate-Term Outcomes	
E	Consumers purchase qualified lighting products appropriate to meet their needs
	➢ LED penetration
	➢ LED saturation
	➢ All efficient bulb saturation
	➢ Market share of all efficient bulbs
	➢ Number of products sold through the program
	➢ Total number of LED and CFL products sold through the program
F	Increased consumer willingness to pay more for lighting
	➢ Consumer willingness to pay
G	Consumers look for ENERGY STAR on lighting
H	Consumers are satisfied with qualified lighting products
	➢ LED Satisfaction
I	Increased consumer demand for qualified lighting
	➢ Market share of all efficient bulbs
	➢ Number of products sold through the program
	➢ Total number of LED and CFL products sold through the program
J	Satisfied consumers serve as brand ambassadors
K	Consumer satisfaction with qualified lighting received through Mass Save direct installation

Table 5: Long-Term Outcomes and Indicators from MA Logic Model

Long-Term Outcomes	
L	Increase in retail outlets carrying qualified lighting
M	Additional consumers purchase qualified lighting products
	➢ LED penetration
	➢ LED saturation
	➢ All efficient bulb saturation
	➢ Market share of all efficient bulbs
	➢ Number of products sold through the program
	➢ Total number of LED and CFL products sold through the program
N	Increased availability of qualified lighting among non-participating & participating retailers
	➢ Percentage of shelf space devoted to ENERGY STAR LEDs
	➢ Percentage of shelf space devoted to non-ENERGY STAR LEDs
	➢ Percentage of shelf space devoted to LEDs
	➢ Percentage of all LED models in stock at retail stores that are ENERGY STAR-qualified
	➢ Percentage of products on shelves that are LEDs
O	Market Share of qualified lighting products increases
	➢ Market share of all efficient bulbs
	➢ Market level sales of LEDs (sales per household)

A.1.3 Policy Approaches that Support Market Transformation

The policy environment in Massachusetts currently focuses on supporting resource acquisition-based approaches to energy efficiency. While this does not preclude PAs from pursuing targeted market transformation initiatives, it increases the risk to PAs from market transformation because they may not be credited with the full effects of their programs. This greatly reduces the likelihood that PAs will plan market transformation initiatives and effectively limits opportunities for Massachusetts ratepayers to benefit over the long term from this approach to energy efficiency.

In "Building a Policy Framework to Support Energy Efficiency Market Transformation in California," authors Prahl and Keating note that resource acquisition and market transformation can happen together in the same policy framework, but without appropriate policy safeguards they can undercut each other. Prahl and Keating outline policy safeguards to avoid this "tension" between resource acquisition and market transformation approaches. We summarize these below as they may be appropriate to consider for Massachusetts.

1. Since market transformation is not always the best approach to a market, it should not be considered as a policy objective that is right for all markets. It is more appropriate to frame market transformation as an "intervention strategy" or "policy tool" than as a "policy objective."
2. Market transformation interventions present risks both to program administrators and regulators. These risks can be managed by:
    - *Limiting how much of total program spending is allocated to market transformation.*

- *Establishing a "systematic upfront vetting process" such as that of the Northwest Energy Efficiency Alliance (NEEA).* This includes ensuring there is an approach to "scanning for market transformation opportunities, a process for deciding which opportunities to pursue, and a vision of the desired end-state for the market being targeted and the intended exit strategy for the initiative." Prahl and Keating say the process should involve planners providing a vetting group with a proposal for consideration before a program administrator can implement a market transformation initiative. The proposal materials would include market background information, logic model, and market effects indicators.
- *Using continuous evaluation to alert program administrators and regulators when a program approach needs to change, and lengthening the evaluation cycle.* Long-term market effects and related savings from market transformation initiatives are considerably slower to accrue than short-term savings from resource acquisition. Market transformation is also best served by more frequent, less extensive evaluation activities that provide information to inform and adjust the program as well as track long-term changes in the market and progress toward goals. With continuous evaluation, a series of smaller, discrete evaluation activities are undertaken. These are tied together by longer-term strategic evaluation plans.
- *Collaborating and sharing risks with other jurisdictions and industry.* Markets are national or international, limiting the impact of market transformation efforts even by large jurisdictions. Collaborating with others increases the likelihood of success and reduces the risks to all.

3. Identifying persuasive early or "leading" indicators of market transformation should be a key criterion for vetting and accepting a proposed market transformation initiative. Consider having regulators serve "as 'judges' of the appropriateness of these indicators as part of the up-front vetting process."
4. Explore "incentive mechanisms specific to individual market transformation initiatives that reward program administrators based on near-term, sought-after changes in approved market indicators. Consider that incentive mechanisms developed to encourage resource acquisition may not be effective in encouraging market transformation without modification."
5. It's not necessary to have a cost-benefit analysis approach for market transformation initiatives that is fundamentally different from that for resource acquisition programs. Prahl and Keating note that the "single most important change" to cost-benefit analysis would be "a lengthening of the time-frame covered by the analysis, specifically the handling of up-front costs and delayed benefits."
6. In the case of California, Prahl and Keating note that shareholder incentive mechanisms need to change to facilitate investor-owned utilities implementing market transformation.

A.1.4 Resources for Additional Information

The following papers provide additional details on evaluating market effects.

Eto, J., Prahl, R. and J. Schlegel. 1996. "A Scoping Study on Energy-Efficiency Market Transformation by California Utility DSM Programs." Paper prepared for the California Demand-Side Measurement Advisory Committee. July.

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

NMR Group, Inc. 2013. *A Review of Effective Practices for the Planning, Design, Implementation, and Evaluation of Market Transformation Efforts.* Prepared for Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, Southern California Gas CALMAC Study ID PGE0330.01.

NMR Group, Inc. 2014. *Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs*. November 14. Prepared for the Massachusetts Electric and Gas Program Administrators.

Prahl, R., Ridge, R., Hall, N. and W. Saxonis. 2013. "The Estimation of Spillover: EM&V's Orphan Gets a Home." In Proceedings of the 2013 International Energy Program Evaluation Conference. Chicago, August 13-15.

Prahl, Ralph and Ken Keating. 2014. "Building a Policy Framework to Support Energy Efficiency Market Transformation in California." California Public Utilities Commission.

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.

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[i] The guidance in this document is based on two reports. (1) NMR Group, Inc. 2013. *A Review of Effective Practices for the Planning, Design, Implementation, and Evaluation of Market Transformation Efforts*. Prepared for Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, and Southern California Gas. CALMAC Study ID PGE0330.01. Found here: http://www.calmac.org/publications/FINAL_NMR_MT_Practices_Report_20131125.pdf (2) NMR Group, Inc. 2014. November 14. Prepared for the Massachusetts Electric and Gas Program Administrators. Found here: *Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs.*

[ii] See: (A) Hsu, C. and B.A. Sandford. (2007). —The Delphi technique: making sense of consensus. ‖ Practical Assessment, Research & Evaluation. 12(10): 1-8; (B) Linstone, H. A., & Turoff, M. (1975). The Delphi Method: Techniques and Applications. Reading, MA: Addison-Wesley Publishing Company; (C) Ludwig, B. (1997). Predicting the future: Have you considered using the Delphi methodology? Journal of Extension, 35 (5), 1-4. Retrieved August 25, 2010 from http://www.joe.org/joe/1997october/tt2.ht

[iii] Derived from Keating, et al. *ops cit*., and Sebold et al., 2001. For more detail, see Keating, et al.