

MEASURING MARKET TRANSFORMATION: FIRST YOU NEED A STORY...

Patricia Herman, Barakat & Chamberlin, Oakland, CA
Shel Feldman, Shel Feldman Management Consulting, Madison, WI
Shahana Samiullah, Southern California Edison, Rosemead, CA
Kirsten Stacey Mounzih, Pacific Gas & Electric Company, San Francisco, CA

Introduction

Market transformation is a good idea. It makes sense to focus efforts on improving the market structure for energy efficient measures so that they are adopted on their own merits. In contrast to direct resource acquisition schemes (rebates), a transformed efficiency market should result in more and longer lasting energy savings at a lower cost to society as a whole.

In preparation for the implementation of market transformation programs, many utilities are launching studies to measure market effects. Market effects are changes in the market for energy efficient measures that are believed to show evidence of a market's transformation. Lists of these effects have been developed and they include indicators such as changes in consumer attitudes and awareness, and changes in equipment stocks. Estimating these market effects is not going to be easy, but it certainly is do-able. However, the estimation of market effects will by itself *tell us almost nothing about market transformation*. Market effects will reveal little of use without a "story."

Taken by itself, an increase in customer awareness, for example, does not indicate market transformation. One must also know:

- Whether a lack of customer awareness was a key market barrier—i.e., a barrier whose existence was limiting to a significant portion of the net benefits possible;
- Whether there exist other barriers that will be equally or more limiting to net benefits even with the reduction of the awareness barrier; and
- The reasons behind the change in awareness in order to determine whether any reduction is likely to be lasting and to determine the course of future interventions.

Markets are complex structures. There are many actors involved, each with its own set of decisions and interrelated communication and delivery channels. In order to determine whether a market has been made more efficient through the reduction of market barriers—i.e., whether a market has been transformed—we must understand the whole structure—

know the whole story. Because of this the determination of market transformation is a significantly more complicated task than the measurement of DSM program impacts. In the case of DSM, the objective is to measure the direct, expected specific (i.e., kWh savings from particular known measures) results of program intervention on particular customers—participants. Here we must measure a variety of interrelated, indirect, and hypothesized, but yet unknown results of a variety of interventions on all levels of actors in a market.

Overview

This paper presents the results of a market characterization (our name for the "story") performed to measure the market effects of two residential new construction programs: Southern California Edison's *Welcome Home* program and Pacific Gas & Electric's *Comfort Home* program.

These programs were not designed to be market transformation programs. The *Welcome Home* and *Comfort Home* programs were designed and operated as demand-side management (DSM) programs—i.e., they were intended as a means to directly acquire demand and energy savings.

Even though DSM programs can also have market transformation effects, this is not their main purpose. Programs that are specifically designed to the purpose of market transformation are fundamentally different: they focus on market structure rather than direct acquisition. Edison and PG&E requested and received permission to fund an evaluation the market effects of the *Welcome Home* and *Comfort Home* programs in preparation for future market transformation efforts.

The market characterization report is the first in this study of market effects. Its purpose is to define the characteristics of the residential new construction market. This definition is needed to identify the key market barriers in the market to then determine the appropriate market effects upon which to focus the remainder of the study dollars.

Organization of This Paper

This paper begins with a discussion of the definitions used for key market transformation terms, and the refinements to those definitions that became apparent through the process of our study. The next section defines the scope of this study pointing out the importance of our choice of a

forward-looking approach to the study. The next section presents key aspects of our approach and the following section presents a summary of the market structure, including the decisions and key market barriers for each category of market actors. The last section presents the market effects recommended to measure the reduction of the key market barriers identified.

Definitions

We grounded our study in the definitions of key market transformation terms developed in the Eto, Prah, and Schlegel scoping study.¹ In practice—as we developed the market characterization—we discovered that we needed several refinements to these definitions. We discuss the key definitions and our refinements below.

Market Barrier. The scoping study defined a market barrier as follows:

Any characteristic of the market for an energy-related product, service, or practice that helps to explain the gap between the actual level of investment in or practice of energy efficiency and an increased level that would appear to be cost beneficial.

As we went through the process of identifying and defining the market barriers in the residential new construction (RNC) market, we realized that this definition could be interpreted to be too inclusive. The problem we encountered is that something can “appear to be cost beneficial” and not be. Costs can be higher than expected. Benefits may not last as long as expected or be as large as expected. If a closer examination of a market reveals that a particular energy-related product, service, or practice is not cost beneficial, the cost that has been left out (or the reduction in benefits from what they first appeared to be) should not be considered a market barrier.

In this vein, it should be noted (as discussed in the scoping study) that cost is *not* a market barrier. The term “market barrier,” by definition, implies that a measure is cost beneficial. Therefore, we have already determined that the benefits outweigh the costs—i.e., the costs are not too large when compared to benefits, and thus, something else must then be the reason for non-adoption.

Market Effect. The scoping study defined a market effect as:

A change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy-efficient products, services, or practices and is causally related to market intervention(s).

In general, this definition seemed to work well for us. The one enhancement we made in use is to explicitly tie market effects to market barriers. This definition refers to the need to causally relate market effects to market interventions. And the definition for market interventions in the scoping study states that they are efforts to reduce market barriers. Therefore, a market effect is causally related to an effort to reduce particular market barriers. We interpreted the use of the word “reflective” to allow market effects to exist that do not result in actual changes in energy efficiency adoption because of other key market barriers not being reduced.

We also found it useful to define whether a market effect was created by an intervention that reduced, eliminated, or bypassed a market barrier. A bypassed market barrier still exists. It can be overcome by a market intervention and a temporary market effect can result, but if that intervention is removed, the market barrier remains and the market effect disappears. Therefore, a market effect caused by an intervention that bypassed a market barrier is not likely to be a lasting effect. A market effect that was caused by an intervention that eliminated a market barrier is likely a lasting effect, and one that was caused by an intervention that reduced a market barrier will lie somewhere in between.

Market Transformation. The scoping study defined market transformation as:

A reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced, or changed.

Several concepts are key in this definition:

- Market transformation is a method to promote economic energy efficiency through enhancing the efficiency of a market (see the definitions of market barrier and market effect).
- It is targeted at energy efficiency measures that are cost beneficial, but not being adopted by customers (see the definition of market barrier).
- It is focused on the market structure for the measure (see the definition of market effect).

¹A Scoping Study on Energy-Efficiency Market Transformation by California Utility DSM Programs by Joseph Eto, Ralph Prah, and Jeff Schlegel, for The California Demand-Side Measurement Advisory Committee (CADMAC) Project 2091T, July 1996. Hereafter called the “scoping study.”

- Its goal is to achieve lasting changes in the market structure (see the definition of market transformation).
- Its effects are not normally limited/confined to a particular area or service territory (implied by the focus on a market structure).

This definition does not, however, provide information by which to determine when market transformation activities are justified, or when market transformation is complete—i.e., when a market should be considered transformed. This information is provided by the scoping study text after the definition. The text explicitly says that:

. . . if there are lasting effects and the most important and relevant market barriers have been reduced to the point where further intervention is no longer deemed to be net beneficial to society, then the market has been completely transformed.

This implies that market transformation activities are justified as long as they provide net benefits to society—i.e., the net benefits to society from the market effects are large enough to cover the cost of the market intervention(s).

Scope of this Study

During the kick-off meeting for this project, the team decided that this study should have a forward-looking goal of better design of future market transformation programs. This goal was given priority over the more backward-looking goal of the measurement of the actual market effects of the *Welcome Home* and *Comfort Home* programs.

This decision had two main impacts on the study. First, it caused us to focus more of our efforts on measures for which further intervention is likely to be cost beneficial—and is likely to remain cost beneficial into the implementation phase of a future market transformation program.

When Title 24 was revised in 1992 (and went into effect January 1993), many of the measures promoted by the earlier versions of the programs were incorporated into the new standards. Whether intervention to promote a measure is cost beneficial or not depends on whether the value of the energy savings and other benefits of that measure over those of *the standard in the market at that time* exceed the costs of that measure over the costs of *the standard at that time*. If the 1992 Title 24 standards are the new standard, then the incremental benefits of a measure over Title 24 must exceed

the incremental costs over Title 24 plus the cost of the intervention.²

Therefore, an “energy efficient home” is defined in this report as one that uses less energy than—is more efficient than—Title 24 would require. The market is, by definition, transformed for all measures already required by Title 24. Our focus is then on measures not already incorporated into Title 24 where further intervention is likely to produce net benefits—benefits that exceed the cost of intervention.

The second implication of our forward-looking goal is the focus on remaining market barriers. Certain market barriers were in existence when the *Welcome Home* and *Comfort Home* programs were designed and put in place that no longer exist. For example, energy efficient windows were in shorter supply in the late 1980s and early 1990s than they are now. The availability of these windows was a market barrier for the earlier years of these programs. Now due to a variety of factors including huge efforts in the Northwest and the Title 24 labeling requirements, efficient window availability is no longer a problem. Therefore, we give more attention to those market barriers that are likely to effect future market transformation in the residential new construction market.

Overview of Our Approach

The purpose of this characterization of the RNC market is to serve as the basis for our identification of the market effects to study in the remainder of the project. What we wanted from the market characterization is a detailed, validated description of the market structure. This description of the market structure included identifying all relevant market actors, their decisions and the influences on those decisions, and the market barriers they face in those decisions. Once we identified the key market barriers in the market, we can then determine the market effects to measure to show whether these barriers have been reduced.

We identified the market actors and their decisions and the influences on their decisions using project team expertise, interviews with market experts, interviews with a small number of market actors, the scoping study, and other sources. We then used what we believe to be an innovative approach to identifying the market barriers in this structure. This is described below. We then made a series of assumptions to determine the key market barriers in this structure. There were several dimensions to our subjective assessment of whether a market barrier should be considered “key.” These are also discussed below.

²Actually, the appropriate focus is on measures that are more efficient than what *would have been installed* under Title 24. The distinction is between actual and expected compliance.

Our “Up-Stream” Approach to the Identification of Market Barriers

Our approach to identifying market barriers moved up the delivery chain (“up stream”) from homeowners to equipment manufacturers. This proved to be the easiest way to identify the barriers for each actor. In order to identify the market barriers for a particular actor, we assumed that the market down-stream from that actor was completely efficient—i.e., that the down-stream actors faced no market barriers. For example, we determined the market barriers for builders by assuming that homeowners faced no market barriers—i.e., they demanded of builders exactly the level of energy efficiency that would be cost beneficial to society. We then identified builders’ market barriers by asking the question: If the message was getting to builders, what would keep them from passing it on?

The Benefits of an “Up-Stream” Approach to the Identification of Market Barriers

Our approach of moving “up-stream” from homeowners to manufacturers allowed us to clearly identify, differentiate between the characteristics of, and acknowledge the interrelationships between the barriers for each actor. For example, both builders and their subcontractors face “split incentives”-type market barriers. Neither sees the direct benefits of energy efficiency—lower energy bills. However, both see alternative, but different possibly-energy-efficiency-related benefits. However, instead of simply listing “split incentives” as a barrier for each, we were able to more specifically determine what was happening.

The “split incentives” barrier is structured similarly for both, but the barriers’ reductions would be evidenced by different market effects. One of the key influences on builders’ decisions regarding home design is marketability. It is possible that energy efficiency (or at least the appearance of energy efficiency) would improve a home’s marketability. One implication is that it would be useful to measure builder perception of homeowner desires to estimate the reduction of this barrier.

Subcontractors, on the other hand, are strongly motivated towards keeping the builder happy. If the builder is asking for energy efficiency, the subcontractor will deliver to the point of builder satisfaction—which may or may not result in actual energy efficiency. Changing builder/subcontractor relationships and practices would be indicators of this barrier’s reduction.

The “up-stream” approach also illuminates the hierarchy of market barriers. The removal of a down-stream actors’ market barriers is necessary for market efficiency since that barrier also controls all up-stream actors’ actions. But the removal of the down-stream actors’ barrier is not sufficient for market efficiency, since a remaining up-stream barrier will then take its turn to block the market’s flow.

For example, the builder’s split incentives barrier dilutes the impact of the subcontractor’s decisions and

barriers on the market for energy efficiency. The ideal situation would be to be able to eliminate both barriers. However, if only one is targeted, the largest market impact would come from removing the builder’s barrier. This is because removal of the subcontractor’s barrier without removing the builder’s barrier would do little to improve the market for energy efficiency.

Finally, our “up-stream” approach allows us to better target where a barrier actually exists in a market. The fact that HVAC subcontractors may oversize an air conditioner is not in itself a market barrier. It is only a barrier if the builder specifically requests a particular sized air conditioner and then the subcontractor still finds a way to oversize it. In the most efficient market, the subcontractor will still respond to what is requested by the builder. That is the market mechanism. The barriers that result in air conditioner oversizing most likely lie with the builder either in terms of not choosing to build an energy efficient house, or in terms of not conveying (or not being able to convey) the desired sizing in the specifications to the contractor.

The Dimensions of the Definition of “Key” Market Barriers

The set of market barriers we discuss in this report is not exhaustive. We took a subjective approach to limiting the barriers included to those we considered to be “key.” In general, we considered a key market barrier to be one that prevents a large portion of what would be an efficient (cost beneficial to society) stream of energy efficiency from getting to the end user. There are several dimensions to our definition of a key market barrier.

First, what is considered a “large portion” is entirely subjective. We tried to prioritize potential impacts at least conceptually, and to focus on the largest ones.

Second, some market barriers may have been key in the earlier years of the programs, but are no longer considered important. Given our forward-looking focus, we decided not to concentrate on these already-overcome barriers.

For other barriers, the impact of the barrier depends on the current cycle of the market. For some “practices” market barriers, the barrier is actually the “lumpiness” of the practice. For example, some upgrades in window efficiency require manufacturer re-tooling (e.g., the injection of argon gas). Some require entirely new plants (e.g., vinyl window frames). The impact of the barrier increases with the resistance to change as practices move toward the need for quantum leaps.

Finally, some market barriers may cost so much to overcome, that their reduction is not worthwhile. If there is little hope of generating net benefits to society from a barrier’s reduction, why spend a lot of effort on it? This problem is directly analogous to the problem the industry faced when it first started to address externalities with regard to energy production. Externalities have damage costs—the costs or reductions in benefits to society from allowing the

externality to happen. There are also control costs—the cost to society of preventing the externality from happening. The ideal balance for society is to reduce externalities to the point where the damage costs equal the control costs—where the elimination of one more unit of the externality would cost more than the benefits it would create.

The situation is the same when addressing market barriers. The damage costs of market barriers are the lost benefits to society of allowing the barrier to continue—the lost energy savings and other benefits net of measure and other costs. The control costs of market barriers are the cost of the market interventions. Again, the ideal balance is the point where the damage costs equal the control costs—i.e., reduce market barriers only to the point where the benefits exceed the costs of intervention.

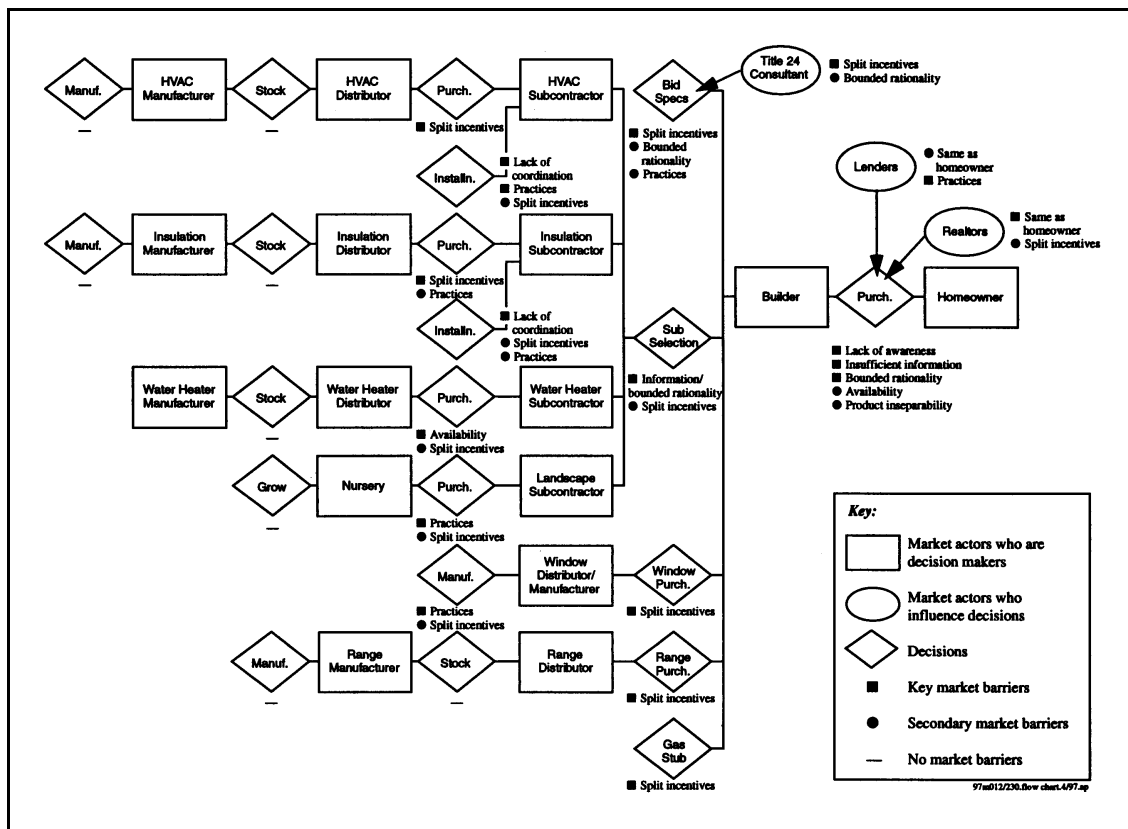
The lack of coordination barrier is an example of a barrier that may have a large impact on the market, but might be extremely expensive—and thus, not worthwhile—to eliminate. One of the ways home costs are kept down in the

residential new construction market is through the practice of bringing in one trade after another to build a home and letting each deal with the results of the previous contractors' work. Good coordination would require more up-front planning and design—including, for example, the use of a mechanical engineer to lay out the HVAC system ahead of time—and more ongoing on-site management. Both of these are believed to add significantly to home costs.

Structure of the Residential New Construction Market

Figure 1 provides a schematic picture of the RNC market structure. Table 1 summarizes the actors, measures, decisions, and market barriers identified in Figure 1.³ In both the figure and the table *italics indicate the key market barriers for each actor*. As the market structure was laid out, the key market barriers for each actor became apparent. Our selections of the key market barriers for each actor were

Figure 1. Market Structure of the Residential New Construction Market



³For more detail on these market characteristics by category of market actor please see the report “Residential New Construction Market Characterization” prepared for Shahana Samiullah of Southern California Edison and Kirsten Stacey Mounzih of Pacific Gas & Electric by Barakat & Chamberlin, Inc. and Shel Feldman Management Consulting, December 6, 1996.

then validated through the expert and market actor interviews mentioned above.

Market Effects to Study

In the last section, we identified the key market barriers for each market actor in the RNC market. In this section, we identify the market effects that evidence the reduction or elimination of the key barriers for the market as a whole.

In a market structure, information regarding end user demands flows up stream stimulating supply (or the desire to supply) and its corresponding derived demand to each higher level. Products and services flow back down this system. Market barriers can be seen as blockages or partial blockages in the system. Since the initial blocks encountered in the system as information on demand flows up stream will likely tend to have the largest impact on the market, we considered these to be the key market barriers for the market as a whole.

Table 1: Summary of the Characterization of the Residential New Construction Market

Actor	Measures	Decisions	Market Barriers
Homeowner	All	Home “package” to purchase	<ul style="list-style-type: none"> • <i>Lack of awareness</i> • <i>Insufficient information</i> • <i>Bounded rationality</i> • Availability • Product inseparability
Realtor/Builders’ sales staff	All	Influences homeowner decision	<ul style="list-style-type: none"> • Same as homeowner (<i>same key market barriers</i>), plus • Split incentives
Lender/Builders’ financing dept	All	Influences homeowner decision	<ul style="list-style-type: none"> • Same as homeowner, plus <i>Practices</i>
Builder/General Contractor/ Developer	Efficient HVAC systems, windows, insulation, water heaters, and shade trees	Specifications to bidders and window manufacturers	<ul style="list-style-type: none"> • <i>Split incentives</i> • Bounded rationality
	Efficient HVAC systems, insulation, water heaters, and shade trees	Subcontractor selection	<ul style="list-style-type: none"> • <i>Information/ bounded rationality</i> • Split incentives
	Efficient windows	Manufacturer/distributor from which to purchase windows	<ul style="list-style-type: none"> • <i>Split incentives</i>
	Gas range	Whether to put in a gas range or cooktop versus electric	<ul style="list-style-type: none"> • <i>Split incentives</i>
	Gas dryer stub	Whether to put in a gas stub for a gas clothes dryer	<ul style="list-style-type: none"> • <i>Split incentives</i>
Title 24 consultant	All	Influences builder “spec” decisions	<ul style="list-style-type: none"> • <i>Split incentives</i> • Bounded rationality
HVAC subcontractor	Efficient HVAC, duct work, and duct insulation	Distributor from which to purchase HVAC equipment and actual equipment to purchase Distributor from which to purchase insulated duct work and the size of the duct work	<ul style="list-style-type: none"> • <i>Split incentives</i>
		Installation of duct work	<ul style="list-style-type: none"> • <i>Lack of coordination</i> • <i>Practices</i> • Split incentives
Insulation subcontractor	Insulation: wall, ceiling, and floor	Distributor from which to purchase insulation and actual insulation to purchase	<ul style="list-style-type: none"> • Split incentives • Practices

Actor	Measures	Decisions	Market Barriers
		Installation of insulation	<ul style="list-style-type: none"> • <i>Lack of coordination</i> • Split incentives • Practices
Water heater subcontractor (plumber)	Efficient gas water heater	Distributor from which to purchase water heater and actual water heater and size to purchase Installation of water heater and pipes	<ul style="list-style-type: none"> • <i>No key barrier</i> • Split incentives
Landscape subcontractor	Shade trees	Nursery from which to purchase trees Actual placement and planting of trees	<ul style="list-style-type: none"> • <i>Practices</i> • Split incentives
HVAC system distributor	Efficient HVAC system	Efficiency levels to stock Manufacturer from which to purchase HVAC	<ul style="list-style-type: none"> • None
Duct work distributor	HVAC duct work and duct work insulation	R-values and types of duct work to stock Manufacturer from which to purchase duct work	<ul style="list-style-type: none"> • None
Window distributor/ manufacturer	Efficient windows	Types of windows to manufacture and stocking practices	<ul style="list-style-type: none"> • <i>Practices</i>
Insulation distributor	Insulation: walls, ceiling, and floor	R-values and types of insulation to stock Manufacturer from which to purchase insulation	<ul style="list-style-type: none"> • None
Gas water heater distributor	Efficient gas water heater	Efficiency levels of gas water heaters to stock Manufacturer from which to purchase gas water heater	<ul style="list-style-type: none"> • None
Gas range distributor	Gas range	Manufacturer from which to purchase gas range	<ul style="list-style-type: none"> • None
Nursery	Shade trees	Types of trees to stock	<ul style="list-style-type: none"> • None
HVAC manufacturer	Efficient HVAC system	Efficiency levels of HVAC systems to manufacture	<ul style="list-style-type: none"> • None
Duct work manufacturer	HVAC duct work and duct work insulation	R-values and types of duct work to manufacturer	<ul style="list-style-type: none"> • None
Insulation manufacturer	Insulation: walls, ceiling, and floor	R-values and types of insulation to manufacturer	<ul style="list-style-type: none"> • None
Gas water heater manufacturer	Efficient gas water heater	Efficiency levels of gas water heaters to manufacture	<ul style="list-style-type: none"> • None
Gas range manufacturer	Gas range	Types of gas ranges to stock	<ul style="list-style-type: none"> • None

Table 2 contains the key market barriers in the residential new construction market. The table also contains the program interventions directed at each barrier and the market effects that would evidence the reduction or elimination of each of these key barriers.

Although we show the program interventions that directly affect each barrier, certain interventions can be thought of as affecting other barriers indirectly. For example, the interventions directed at realtor and lender barriers will also indirectly affect homeowner barriers. These interventions and those directed at the homeowner will also indirectly affect the builders' split incentives barrier.

As discussed in earlier sections, whether a market effect is lasting or not depends on the barrier and on the nature of the intervention. In general, an intervention must directly address and reduce a barrier rather than simply bypass it if the market effect is to last. If the information provided homeowners and realtors is learned and retained, the market effects for homeowners and realtors can be said to be reduced and may last. Similarly, if HVAC subcontractor and realtor training has been successful and that knowledge is retained, their barriers can be said to be reduced and may last. The indirect effect of any learning that may have happened due to other interventions may have reduced

builder barriers and produced lasting effects. However, the market effects solely caused by incentives to builders or homeowners are not likely to last.

Summary

The market characterization has resulted in a list of market effects to study to determine market transformation in the RNC market. This list of market effects is directly tied to specific market barriers and these barriers are known to be the key barriers in the market. No market effects are listed that do not tie to key market barriers, therefore, funds will not be wasted measuring market effects that only seem to be important before the fact.

The interventions that were aimed at each barrier are also known. This identification aids in assigning causality.

The market structure has been laid out so that the changes measured for market effects can be interpreted. That is, if the study of market effects indicates that one or two key barriers have been reduced, but the others have not been, there is a format available to determine what the overall impact on the market is likely to be. Finally, this format also helps determine the course of future interventions.

Table 2. Market Effects to Measure for Each Key Market Barrier

Market Barrier	Interventions	Market Effect
Homeowner information-related barriers	<ul style="list-style-type: none"> • Advertising • Information packets • Incentives (coupons) 	<ul style="list-style-type: none"> • Homeowner demand for energy efficiency, especially with respect to other desirable home characteristics
Realtor information-related barriers	<ul style="list-style-type: none"> • Information packets • Training 	<ul style="list-style-type: none"> • Realtor knowledge with regard to energy efficiency and its benefits • Realtor promotion of energy efficiency
Lender practices barrier	<ul style="list-style-type: none"> • Promotion of energy-efficient mortgages • Discounts off closing costs 	<ul style="list-style-type: none"> • Increased sales of energy efficiency mortgages • Increased awareness and availability of energy efficiency mortgages
Builder split incentives with regard to specifying energy efficiency in home design	<ul style="list-style-type: none"> • Incentives • Standards for ductwork installation 	<ul style="list-style-type: none"> • Builder belief that energy efficiency increases a home's marketability enough to justify its additional costs • Builders designing homes more energy-efficient than Title 24 on own • Title 24 consultants now report percent efficiency above Title 24 rather than simple pass/no pass
Builder information/bounded rationality barrier with regard to subcontractor selection	<ul style="list-style-type: none"> • Incentives • Standards for ductwork installation 	<ul style="list-style-type: none"> • Builders have more information and experience with the ways subcontractors do or do not deliver on energy efficiency • Builders are aware of the ways subcontractors cut corners and have developed safeguards against
Subcontractor lack of coordination barrier	<ul style="list-style-type: none"> • No direct intervention 	<ul style="list-style-type: none"> • Changes in practices which allow for better subcontractor coordination
HVAC subcontractor practices barrier	<ul style="list-style-type: none"> • Standards for ductwork installation • Training • Testing 	<ul style="list-style-type: none"> • Changes in ductwork installation practices