

## Section 3

# PROGRAM DESIGN LOGIC

## INTRODUCTION

This section provides an overview of market events, market actors, and market barriers as they relate to the **New York Energy Smart<sup>SM</sup>** portfolio of programs and intervention strategies. The section briefly addresses: (1) market events and activities, discussing how they influence market structure and market actor relationships; (2) market barriers, identifying and describing the barriers within each market sector, and in some cases sub-sectors (*e.g.*, the residential lighting fixture markets); (3) program intervention strategies, summarizing the **New York Energy Smart<sup>SM</sup>** program interventions that target specific barriers in the marketplace; and (4) reasonable three-year expectations of market transformation programs. Understanding markets is critical to identifying where and how to effectuate changes in energy-efficiency practices and behaviors in the State. Appendix B of this report provides a brief summary of the electricity-use and electric-using equipment in New York's residential (including low-income), commercial, and industrial sectors that helps provide the basis for targeting programs on particular electric end-use and market sectors.

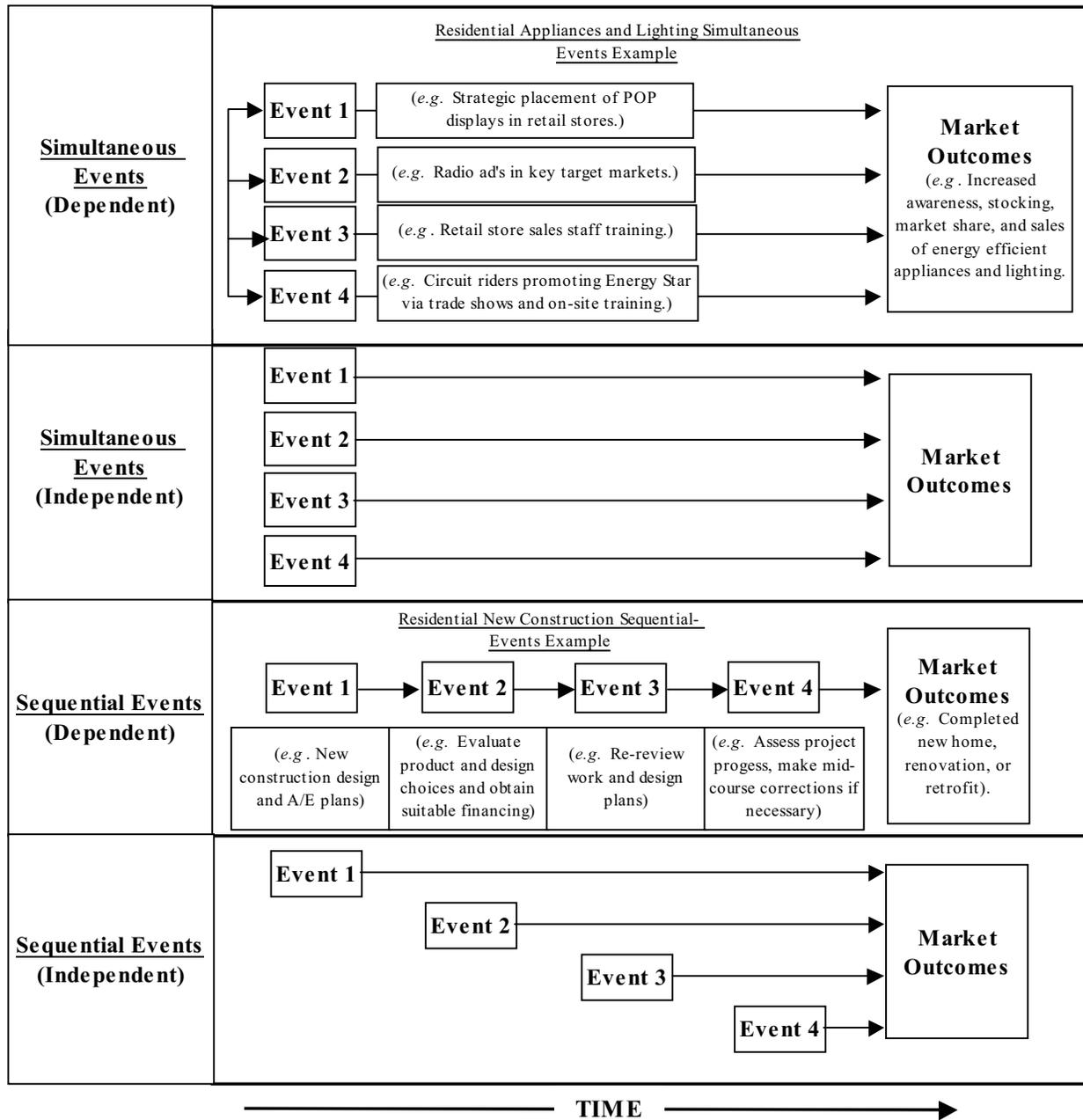
## MARKET EVENTS AND ACTIVITIES

Market events are the defining elements of markets and bring together willing buyers and sellers of energy products and services. Actions taken by market participants (*e.g.*, vendors, retailers, manufacturers, end-users, etc.) dictate the size, speed, and development of market events. Energy market events are generally of three types:

1. New activities initiated (*e.g.*, new construction);
2. Replacement activities upon breakage, failure, or burn-out and new (net) acquisitions; and
3. Retrofit activities initiated (*e.g.* remodeling, modified use etc.).

Understanding the interactions that occur within and between each of these market events is important for characterizing markets and identifying the actors that drive decisions within each market. Market events can be simultaneous or sequential, with varying degrees of interrelatedness (*e.g.* dependency). Simultaneous events typically occur independent of one another and involve a number of different market actors, as shown in Figure 3-1. For example, consumer decisions regarding new home construction and financing can be independent of equipment and appliance purchases.

**FIGURE 3-1: Illustration of Market Events**



These decisions involve financial institutions as well as equipment and appliance dealers as market actors.<sup>1</sup> Sequential events follow a prescribed pattern of activity. For example, in the residential new

<sup>1</sup> The home owner may have existing appliances, and therefore does not need to finance or directly purchase new appliances. If the home owner does need to purchase new appliances (ovens, lights, clothes washers, etc.) they will do so according to their own likes and dislikes through the most appropriate market channel. Up-front planning and financing for these products though concurrent with home design and financing, is not necessarily dependent.

construction market one of the first events is construction design developed by architects, engineers, and contractors (*e.g.*, new house, addition, retrofit, etc.). This event occurs prior to a home-owner's final decision on design and equipment specifications. The home-owner then determines the necessary financing and choice of lending institution. The third event involves the home-owner's oversight of the construction work acting as project manager. In the fourth event the home-owner, architect, and contractor assess progress and determine whether any mid-course revisions are necessary in financing, material purchases, or design plans. Each of these four events (and countless sub-events) comprise a logical path to the final market outcome (*e.g.*, a completed new home, addition, or renovation). If the home-owner deviates from this prescribed order of events (*e.g.*, by obtaining financing prior to selecting a design and equipment specifications) then market outcomes might be inconsistent with prior expectations.<sup>2</sup>

Market events that occur independent of one another involve different market actors and present different barriers. Together these differences create unique market structures. For example, the market for residential kitchen lighting fixtures in the new construction market consists of new home buyers; builders who take the lead in offering available choices to the home buyer; and electrical contractors involved in lighting supply and installation. The residential kitchen lighting fixture market for replacement or additions in existing homes generally consists of consumer purchases at retail lighting stores, home improvement stores, discount stores, or department stores. However, complete kitchen remodeling might involve a kitchen remodeling contractor or a specialty kitchen equipment and appliance store - a market event in which the actors bring an altogether different sales process and perspective to the decision-making process compared to the replacement market. Viewing markets as illustrated in Figure 3-1 allows program managers to develop specific market intervention strategies at selected points along the decision continuum to increase the likelihood of a program's success.

### **Market Structure and Market Actors**

The number of relevant markets to evaluate for public benefit program purposes can be very large when markets are defined as a particular combination of market events, actors, and products and services. Market structure is a complex network of interrelated events and actors that define the market for a particular product or service. These events, actors, and interactions create a structure, which can and does evolve over time as new products are introduced, new information is passed on, or as market actors enter or leave the market. Market actors may be one of the most critical influences in markets. Actors are major decision drivers, and are often the liaison between one another (to pass technical information along from one actor to the next, increase awareness, suggest products, and influence decisions).

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<sup>2</sup> For example, home-design may be scaled down, product quality may diminish, work plan may take longer than expected, added costs may burden home-owner beyond original expectations, etc.

Understanding the structure and actors that comprise a market is critical to defining and understanding the barriers that inhibit efficient market functioning. Identifying the key market actors (those who hold the most influence over the market through influencing decisions - *i.e.* architects and contractors in the residential new construction market) is integral to identifying barriers, as well as understanding the market in other capacities. This information is then used to develop intervention strategies to overcome market barriers. The **New York Energy Smart<sup>SM</sup>** program targets specific barriers that prevent or inhibit greater adoption and use of energy-efficient products and services. Some of the most influential market actors with regard to implementing and supporting these intervention strategies, as well as overcoming market barriers are midstream actors such as retailers, vendors, and contractors. The importance of these midstream actors to efficient market functioning, and to the successful deployment of the **New York Energy Smart<sup>SM</sup>** programs is highlighted below.

### Midstream Market and Market Actor Perspectives

Planning market transformation activities requires an examination of the market events, steps, actors involved, and barriers in the purchase decision for an energy efficiency product or service.<sup>3</sup> Program intervention strategies are then designed to overcome identified barriers as they affect the purchase decisions. Most market transformation interventions are attempting to overcome barriers that are stalling the adoption cycle for a particular efficiency technology. In essence, the benefits of market transformation programs are realized when market barriers to advancing an energy-efficient product or service are mitigated or removed. As depicted in Figure 3-1, market barriers can be present at any step in the purchasing-delivery process, and therefore, with any market actor. As a result, it is useful to evaluate how the product or service “flows” from upstream actors to end-use consumers. For example, a significant market barrier with an upstream or midstream actor could create a bottleneck preventing end-use consumers from choosing efficiency options. This suggests that midstream market actors are key leverage points in changing how a market functions with regard to energy efficiency.<sup>4</sup>

In a well functioning market, the flow of goods to ultimate consumers occurs efficiently; there are no information bottlenecks and there are many products and services from which to choose. When a market is not functioning efficiently, and there is no attempt by market actors to improve efficiency, deliberate

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<sup>3</sup> Spellman, Richard F., Megdal, Lori. “Market Transformation Programs Help Utilities Meet Customer Needs and Environmental Challenges.” *Natural Gas Journal*. September 1999

<sup>4</sup> In an efficient market, consumers and other market actors have sufficient information about the benefits and costs of energy efficiency measures and such products are widely available. However, most markets are not efficient. In these circumstances, the midstream market actor can be an important point of influence in decision making.

program interventions might be required, particularly when the efficient market serves the public good.<sup>5</sup> Midstream market perspectives for three **New York Energy Smart<sup>SM</sup>** programs, Standard Performance Contract, New Construction, and Residential Appliance and Lighting are highlighted in the following paragraphs to illustrate the importance of these actors in reducing market barriers and enhancing the efficient development and operation of markets.

Standard Performance Contract. One of the primary goals of the Standard Performance Contract (SPC) program is to build the energy services industry through the promotion of energy efficiency improvements by energy service companies (ESCOs). This program directly targets midstream actors with the goal of developing a network of service providers to promote energy efficiency, provide information, reduce hassle and search costs, provide verification of savings, and package all these attributes as a single service to end-use consumers. This service could help overcome numerous barriers for energy efficiency products and services simultaneously. Encouraging this service and supporting the ESCO industry is one of the overarching goals of the **New York Energy Smart<sup>SM</sup>** program and the impetus for the SPC program. An in-depth case study for the SPC program is presented in Appendix A of this report.

New Construction. The commercial new construction market has many actors and market events that collectively comprise a sophisticated set of decisions. For example, the technical knowledge for designing buildings, from initial conception through building plans, lies with architects while the technical knowledge for the operating equipment lies with system engineers. At the same time, overall building function is the responsibility of the builder and developer. Each of these midstream actors can influence the building's design and equipment specification. These actors work with building owners in an environment where there are many decision points where energy efficiency considerations might be considered. The sequence of decision-making events, and the degree to which midstream actors work together, can in itself cause energy efficiency to be forgotten, or have some features no longer able to be considered given earlier decisions (*e.g.*, day-lighting must be early in the design, efficiency of duct systems must be planned before the lay-out is finalized and can not be added on to the plans later as equipment specification is often considered). Therefore, to increase the energy efficiency practices of the commercial new construction market midstream participants such as, architects, engineers, and builders must work together to achieve common goals.

Residential Appliances and Lighting. Experience with market transformation initiatives in the residential appliance and lighting market indicates that the role of midstream market actors is critical. Several studies reveal that retailers are the key actors for increasing consumer adoption of energy efficiency

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<sup>5</sup> DeCotis, Paul A., Ellefsen, Jennifer, Kim, Helen, Coleman, Mark C. "Determining the Success of Market Development Programs and the Continuing Role of Government." *ACEEE 2000 Summer Study*. American Council for an Energy-Efficient Economy. Washington, DC. August 2000.

measures.<sup>6</sup> As a result, retailers are a focus of consumer product market transformation initiatives. The U. S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA) ENERGY STAR® programs, as well as other programs in the Northwest and Northeast are providing retailer training on energy efficiency measures. In many cases the DOE and EPA work directly with major national retailers, regional organizations, utilities, and appliance buying groups to provide sales training. NYSERDA's Residential Appliance and Lighting program supports these earlier efforts and provides additional services based on current experiences and knowledge of mid-market actor relationships in New York.

## MARKET BARRIERS

The **New York Energy Smart<sup>SM</sup>** program is designed to develop sustainable markets for meeting the public policy goals of New York's public benefits program. This section provides an overview of the barriers inhibiting greater adoption and use of energy efficiency products and services in the residential, commercial, and industrial sectors, as well as those that constrain investments in public benefits R&D.<sup>7</sup> There are several market barriers within and across these sectors including:<sup>8</sup>

- *Information or search costs:* These are the costs of identifying energy-efficient products or services or of learning about energy-efficient practices. These can include the value of time spent learning about or locating an energy-efficient product or service or hiring someone to do it on the consumer's behalf. Search costs can be thought of as the costs of acquiring information to make a purchase decision.
- *Performance uncertainties:* This type of barrier involves the difficulties consumers face in evaluating claims about the benefits and value from energy-efficiency investments and activities. This barrier is closely related to high search costs; acquiring the information needed to evaluate claims regarding performance is rarely without cost. In some instances, it might be difficult to obtain relevant information. For example, direct personal experience might be necessary for consumers to fully understand the benefits and costs of certain courses of action. Producers, as well as consumers, face these costs in forecasting the market response to decisions they make to manufacture, promote, stock, or offer energy-efficient products.

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<sup>6</sup> ACEEE, *Market Transformation Initiatives: Making Progress*. May 1999.

<sup>7</sup> To compile the overview of market barriers in this section, a literature search was conducted of recent research on this topic by NYSERDA and other organizations such as the American Council for an Energy Efficient Economy (ACEEE), the Consortium for Energy Efficiency (CEE), the Northeast Energy Efficiency Partnerships (NEEP), the Northwest Energy Efficiency Alliance (NEEA), the U.S. Environmental Protection Agency (EPA), Lawrence Berkeley Laboratory (LBL) and research conducted by GDS Associates.

<sup>8</sup> Eto, Joe., Prael, Ralph., and Jeff Schlegel. 1996. *A Scoping Study on Energy-Efficiency Market Transformation by California DSM Programs*, Ernest Orlando Lawrence Berkeley National Laboratory, Berkeley, California: LBNL-39058, prepared for The California Demand-Side Measurement Advisory Committee, Project 2091T, pages 13-15.

- *Asymmetric information and opportunism:* This type of barrier introduces another aspect of the difficulties consumers face in evaluating the veracity, reliability, and applicability of claims made by sales personnel for a particular energy-efficient product or service. Sellers of energy-efficient products or services typically have more and better information about their offerings than do consumers. In some cases, sellers also have an incentive to provide asymmetric information. This market barrier is closely related to high information costs and performance uncertainties because obtaining the information required to assess claims adequately may be costly or impossible. This barrier is different from high information costs however, in that appropriate use of the information might require specialized knowledge held only by the vendor; thus, opportunism on the part of those with the specialized knowledge is a concern.
- *Hassle or transaction costs:* This type of barrier includes the indirect costs of acquiring energy efficiency and are closely related to information and search costs. These costs include time, materials, and labor involved in obtaining or contracting for energy-efficient products or services.
- *Bounded rationality:* This type of barrier refers to the behaviors of an individual during the decision-making process that might seem inconsistent with an individual's goals. Consumers often rely on rules of thumb to varying degrees. Sometimes rules of thumb are referred to as matters of habit or custom. Rules of thumb serve to limit the focus or scope of considerations for a given decision. As a result, behavior is often described as rational in intention, but limited in its execution. This barrier is distinct from high search costs, performance uncertainties, and asymmetric information because more or better information alone may be insufficient to change behavior. Instead, this barrier refers to the way in which individuals process and act (not necessarily logically) on whatever information they may have.

These primary market barriers as well as more program specific<sup>9</sup> barriers have been reviewed for this report. The next sections discusses program intervention strategies the **New York Energy Smart<sup>SM</sup>** portfolio has used to target these market specific barriers.

## PROGRAM INTERVENTION STRATEGIES

An understanding of markets, including market events, actors, and barriers is necessary to designing program intervention strategies to influence market participants' behaviors, including consumers. Through this understanding, strategies can be created to guide program development, implementation, and evaluation. These strategies (discussed in the *Proposed Plan for Public Benefit Programs Funded by System Benefits Charge*) provided the foundation for the initial development of the **New York Energy Smart<sup>SM</sup>** portfolio of programs. These led to decisions on where to target intervention strategies: downstream, midstream, or upstream markets.

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<sup>9</sup>“Proposed Plan for Public Benefit Programs Funded by System Benefits Charge”. New York State Energy Research and Development Authority, Albany, New York. May 8, 1998; This plan identified several market barriers to be present in the residential, commercial, and industrial sectors, as well as those that affect investments for R&D programs.

An integral part of the **New York Energy Smart<sup>SM</sup>** program market effort is defining market baselines and developing measurement activities for each program. The market measurement activities provide the ability to measure progress toward the programs goals and is part of the continual program planning and management process. As new information is received from on-going market research studies, NYSERDA continually refines the **New York Energy Smart<sup>SM</sup>** program intervention strategies to ensure that the linkage between those market barriers identified and program intervention strategies continues to exist. The type of intervention needed and its place in the market (upstream, midstream, or downstream) depends on the following three factors:

1. The market sector, product or service, and market structure.
2. The particular market barrier.
3. The market operation as it relates to the actors and barriers, such as who has the greatest influence (the greatest leverage), and where each of the market actors are on the awareness-adoption continuum concerning market barriers, presented earlier in Figure 2-2.

Viewing the process of market transformation as a sequential process of moving market actors at key points through the awareness-adoption continuum provides the foundation for building intervention strategies that support market development in the most cost-effective manner. Due to multiple markets and numerous market barriers, the market transformation process is complex, and developing sustainable markets is a process that takes time to achieve (This is discussed in greater detail at the end of this Section).

The individual **New York Energy Smart<sup>SM</sup>** program efforts administered by NYSERDA span the residential, low-income, commercial and industrial, and research and development market sectors. Seven examples of **New York Energy Smart<sup>SM</sup>** program interventions are provided in the remainder of this Section to show linkages between chosen intervention strategies and key market barriers: at least one in the residential, low-income, commercial and industrial, and R&D sectors. The following provides a breakdown of programs by sector within NYSERDA's portfolio of programs:

- **Nine programs have been designed to influence the residential sector** including remodeling, retrofit, new construction and financing. These include, the Residential Appliances and Lighting program; ENERGY STAR® Public Awareness; Home Improvement Loan Program; New Construction; Building Performance Market Enhancement; Innovative Opportunities; Comprehensive Energy Management Services; Loan Fund Multifamily Building Demonstration programs; and Environmental Disclosure.
- **Five programs have been designed to influence the low-income sector.** These include the Technical Assistance for Low-Income Publically-Assisted Housing; Low-Income Direct Installation;

Low-Income Public Awareness; Affordable Assisted Housing; and Low-Income Aggregation programs.

- **Thirteen programs have been designed to influence the commercial/industrial sectors.** These include the Premium Efficiency Motors; New Construction; Innovative Opportunities C/I; Promoting High-Quality Energy Efficient Commercial Lighting; Commercial HVAC; Standard Performance Contracting; Institutional Energy Performance Contracting Assistance; Energy Audit Pilot; Flex Tech; Energy Feasibility Studies; Energy Operations Management; Rate Analysis and Aggregation; and Loan Fund programs.
- **Eleven programs have been designed to influence research and development** (including renewable technologies, technology development and deployment, environmental monitoring and evaluation sectors). These include the Energy Efficiency R&D; Strategic R&D; Environmental Quality Research; Development and Demonstration of Innovative Ambient Pollution Monitoring Instruments; Environmental Quality Projects; New York State Wind Power Plant Demonstration; Wind Prospecting Program; Residential Photovoltaics; Photovoltaics on Buildings; High Value Photovoltaics and Wind; and Willow Plant Development programs.

A summary of the goals, status, and progress of each of these **New York Energy Smart<sup>SM</sup>** program efforts is provided in Section 6 of this report. These summaries describe the intervention strategies that each individual program is using to address market barriers. In addition, each of the sectors (residential, low-income, commercial and industrial, and R&D) outlined within this Section conclude with a summary table that lists the **New York Energy Smart<sup>SM</sup>** programs by their market sector of influence, and the type of market barriers addressed and the intervention strategy employed. Several NYSERDA documents detail these strategies on a program level and as an integrated approach.<sup>10</sup>

### **Residential Sector - Appliances and Lighting**

This section highlights the workings of the appliances and lighting markets within the residential sector. Each market is described according to its structure, actor networks, and barriers. The **New York Energy Smart<sup>SM</sup>** program intervention strategy used to address these markets and barriers is also described. This section concludes with a display of the various **New York Energy Smart<sup>SM</sup>** program offerings that target

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<sup>10</sup> These documents include: New York State Energy Research and Development Authority, GDS Associates, Inc. and Megdal & Associates. *New York Energy Smart<sup>SM</sup> Program Gap Analysis, Interim Report*. February 2000; New York State Energy Research and Development Authority. *Energy Programs for the Future: Entering the 21<sup>st</sup> Century*. 1999-2002. September 1999; and New York State Energy Research and Development Authority. *SBC-Funded Public Benefits Program, The New York Energy Smart<sup>SM</sup> Program Evaluation Plan*. May 1999.

the residential sector. The display lists market actors and barriers targeted by each program and lists the intervention strategy used to influence these actors and help overcome barriers.

### Residential Lighting Market

Nationally, residential lighting accounts for 10 to 15% of annual residential electricity use. With each home having an estimated thirty or more lighting fixtures, with 85% of these fixtures using incandescent bulbs, the potential for energy savings in this market is substantial. Two primary markets for residential lighting, the replacement bulb market and fixtures market, offer the greatest opportunity for improved energy efficiency.<sup>11</sup>

The residential fixture market is highly fragmented, with over 500 fixture manufacturers nationally. Of these, the 20 largest companies have about 48% of the market share.<sup>12</sup> In addition, six states are home to more than 56% of all U.S. based lighting fixture manufacturing plants: California (236), New York (123), Illinois (77), Pennsylvania (70), Florida (62) and Ohio (58). Lighting manufacturers, such as Catalina, U.S. Industries, and the Genlyte Group, offer products under several brand names and sell to a variety of segments (*e.g.*, commercial, industrial, and residential) - rarely targeting a specific segment. Lighting fixture manufacturers generally compete on style, appearance, and price. The primary location for purchases of portable lamps is discount department stores, while the primary location for the purchase of permanent lighting fixtures is home improvement stores.<sup>10</sup> Figure 3-2 presents a generalized flow of products and services throughout the residential fixture market in the Northeast.

The vast majority of residential lighting sales are for replacement bulbs in existing homes and apartments (as opposed to replacement fixtures). These decisions are predominantly made by the consumers with little interaction with midstream market actors. The greatest proportion of replacement bulbs are purchased in grocery stores which generally have a low stocking rate for compact fluorescent lamps (CFLs). Incandescent bulbs are purchased predominantly from grocery stores, hardware stores, discount department stores, and home centers. CFLs are more commonly purchased from hardware stores or from local electric utility companies.<sup>11</sup> The importance of the replacement market is greater in New York than elsewhere in the country due to a slower rate of new home construction. For example, the new home construction market accounts for 15% of fixture sales in the Northeast, compared to 29% nationally.<sup>13</sup> In contrast, renovations and retrofits account for 19% of fixture sales in the Northeast, compared to 15%

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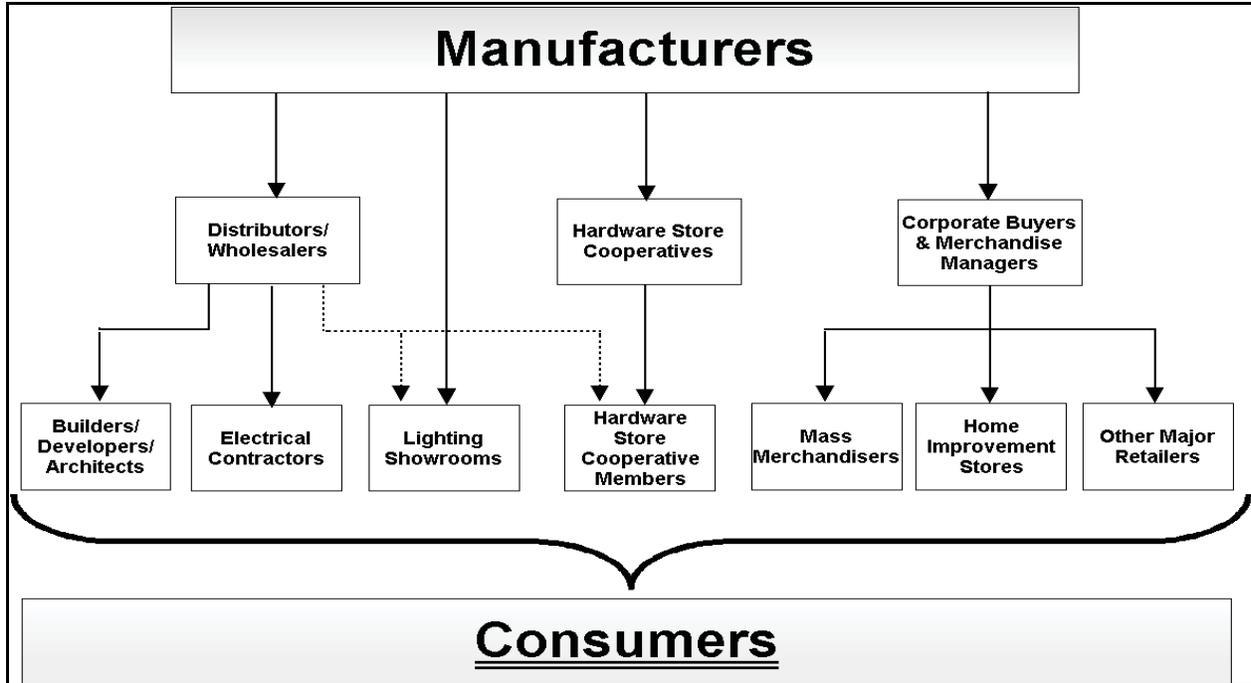
<sup>11</sup> Portland Energy Conservation Inc., and Ecos Consulting. May 1, 1998. *The Northwest Energy Efficiency Alliance LightWise Initiative: Program & Market Progress Report (Review Draft)*.

<sup>12</sup> Opinion Dynamics Corporation. October 1999. *Appliance Sales Tracking 1999 Residential Survey*.

<sup>13</sup> Opinion Dynamics Corporation. June 3, 1998. *Baseline Study of the Northeastern Residential Lighting Market*.

nationally. Although other market actors, including builders and architects, might become involved in lighting decisions in new homes, the consumer remains the primary decision-maker with regard to residential lighting.

**FIGURE 3-2: The Residential Lighting Fixture Market**



Source: Opinion Dynamics Corporation. June 3, 1998. *Research Report: Baseline Study of the Northeastern Residential Lighting Market*. Submitted to: Northeast Energy Efficiency Partnerships, Inc. Pg. 14.

Over 60% of new home buyers in the Northeast believe they (or someone in their household) have ultimate decision-making authority for indoor fixture buying decisions. This is followed by 18% who say the builder is the ultimate decision maker. Interior designers and architects are the least involved market actors in making indoor fixture decisions in new home construction.<sup>11</sup> Since the primary decision-maker for lighting, replacement bulbs, retrofits, and lighting in new construction is the end-use consumer, they are an important focus of energy efficiency lighting promotions.

Barriers in the Residential Lighting Market

Opinion Dynamics Corporation (ODC) conducted market research on the residential lighting market in the Northeast during 1998 for NYSERDA. This research was primarily used to help design and implement strategies for the **New York Energy Smart<sup>SM</sup>** Residential Appliance and Lighting program.<sup>14</sup> The research identified the following market barriers in the residential lighting market:

<sup>14</sup> Opinion Dynamics Corporation. June 3, 1998. *Baseline Study of the Northeastern Residential Lighting Market*.

1. The life of the bulb and energy efficiency are among the most important features valued by Northeast consumers. Some consumers, however, are skeptical about the useful life of compact fluorescent lights (CFLs) and are reluctant to invest in them for this reason.
2. Most people in the Northeast do not spend a lot of time reviewing compact fluorescent lighting product descriptions. The mere presence of energy-saving CFLs in retail outlets may not be enough to encourage consumers to become new CFL bulb users.
3. Northeast consumers do not understand, and to a certain extent may be turned away by, terminology used by lighting professionals (*e.g.*, many consumers associate negative characteristics such as a flicker, a delay, and poor color rendition with the term “fluorescent”).
4. Many of the features that guide consumers’ bulb selections are perceived as disadvantages for CFLs, including the fit of the bulb in the fixture (the most important feature), light output, price, and light color. In turn, many of the features that guide consumers’ selections of portable and permanent lighting fixtures are perceived as disadvantages for energy-efficient fixtures, including the style or appearance (the most important feature), light output, and price.
5. Twenty-seven percent (27%) of consumers do not know whether they prefer CFL or incandescent bulbs when it comes to the amount of electricity used. This may be because these consumers are not able to discern real tangible savings (*e.g.* bill reductions) from the CFL bulbs they have installed, and therefore are unable to draw any comparison.
6. A disconnect exists between where consumers purchase CFL bulbs and where they purchase incandescent bulbs - *i.e.*, supermarkets are one of the primary locations for NE bulb purchases, but supermarkets rarely offer much of a selection of CFLs. The most common place for residential consumers to buy CFL bulbs is from a hardware store (23%) or their utility/electric company (23%).

### Barriers in the Residential Appliance Market

Research conducted in 1999 by Aspen Systems Corporation (Aspen) for NYSERDA for help in designing and implementing the **New York Energy Smart<sup>SM</sup>** Residential Appliances and Lighting program indicates that the awareness level of ENERGY STAR<sup>®</sup> labeled home appliances in New York State is low.<sup>15</sup> At the time of baseline measurement (1999), about one-third of New York consumers were aware of ENERGY STAR<sup>®</sup> by name while about 57% of those who were aware of ENERGY STAR<sup>®</sup> understand its meaning.<sup>16</sup> This low level of awareness in New York State is attributed to poor in-store product positioning of ENERGY STAR<sup>®</sup>

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<sup>15</sup> Aspen Systems Corporation. April 16, 1999. *Selected Baseline Indicators, Residential Lighting and Appliance Program, Phase I.*

<sup>16</sup> ENERGY STAR<sup>®</sup> is a voluntary partnership among the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and state governments, product manufacturers, local utilities, and retailers. Partners help promote efficient products displaying the ENERGY STAR<sup>®</sup> logo and inform consumers about the benefits of energy efficiency. The ENERGY STAR<sup>®</sup> logo is used to symbolize and identify energy-efficient products. Products with this label use less energy, thereby reducing electric bills, and lessening the amount of fossil fuel burned by power plants, and the amount of carbon dioxide and other pollutants emitted into the atmosphere.

products, label recognition, and the lack of available consumer information regarding ENERGY STAR® products and programs. In fact, at the time of baseline measurement, market shares products were below 10% for most ENERGY STAR® products in New York State. Several market barriers exist among midstream market actors, including retailers and vendors. Specific barriers in the residential appliance and lighting market identified by the Aspen Systems research included:<sup>17</sup>

1. New York State appliance, lighting products, and home electronics retailers demonstrate a low level of awareness of ENERGY STAR® labeled products and their benefits.
2. Very few manufacturers of ENERGY STAR® compliant products are placing the ENERGY STAR® logo where it can be recognized.
3. Managers have little knowledge of how to calculate energy savings for their locality or of the other benefits ENERGY STAR® products can provide.

These barriers directly influence consumer awareness, knowledge, preference for and adoption of energy-efficient products and services. For example, the amount of store space provided for point of purchase displays, as well as the in-store product availability affects consumer awareness, perception, and purchasing behaviors. When an informed and knowledgeable sales force is coupled with sales incentives (e.g. customer rebates) and high stocking levels and increased display space for energy-efficient options are available, awareness and adoption of energy-efficient products has the potential to increase beyond levels reported in Table 3-1.

**TABLE 3-1: Average Display Space Provided for ENERGY STAR® Products in New York State<sup>18</sup>**

ENERGY STAR® Retail Category		Percent Display Space Provided	Consumer Reported Purchases of ENERGY STAR® Products as a Percentage of Total Purchases
Appliances	Refrigerator	15.4%	9.8%
	Clothes washer	14.7%	5.7%
	Dishwasher	17.9%	6.5%
	Air Conditioner	25.0%	9.5%

<sup>17</sup> More information on the barriers, baseline research, and program interventions pertaining to the residential appliances and lighting market can be found in the following reports by Aspen Systems: *Implementation Plan: Residential Energy Efficient Appliances and Lighting Market Transformation Program*, June, 1999; *Design Report: Residential Energy Efficient Appliances and Lighting Market Transformation Program*, June, 1999; and *Baseline Report for Energy Star® Programs*.

<sup>18</sup> Aspen Systems Corporation. April 16, 1999. *Selected Baseline Indicators, Residential Lighting and Appliance Program, Phase I*.

<b>Lighting Products</b>	Light bulb	10.5%	n/a
	Compact Fluorescent Bulbs	n/a	0.0%
	Suspended Light Fixture	0.4%	2.2%
	Ceiling Mounted Fixture	2.7%	2.8%
	Wall Mounted Fixture	1.2%	6.3%
	Recessed Fixture	1.8%	3.4%
	Portable Fixture	1.2%	6.9%
	Exterior wall/post mounted fixture	1.9%	5.2%
	Cabinet integrated fixture	0.0%	3.3%
<b>Home Electronics</b>	TV	17.2%	17.6%
	VCR	30.8%	22.2%
	TV/VCR	14.2%	n/a

Mid-market actors like retail stores have the ability to reduce some market barriers, and thus influence the sale of energy-efficient products. NYSERDA is influencing these market actors through **New York Energy Smart<sup>SM</sup>** program interventions, as described below.

Intervention Strategies and Residential Appliances and Lighting

Several of the **New York Energy Smart<sup>SM</sup>** programs work together to address the residential appliances and lighting markets. For example, the ENERGY STAR<sup>®</sup> Residential Appliances and Lighting initiative focuses on midstream market actors, and the ENERGY STAR<sup>®</sup> Awareness Campaign was designed to promote consumer awareness. The midstream program works with retailers, remodelers, builders and manufactured home dealers in an effort to improve stocking, display, promotion and labeling of ENERGY STAR<sup>®</sup> products. The goal of this program is to achieve a three percent increase in market penetration of ENERGY STAR<sup>®</sup> appliances, lighting, and home electronics products over the two-year duration of the program. As described earlier, some of the market barriers for residential appliances and lighting include information or search costs, performance uncertainties, asymmetric information, product availability, and hassle costs.

Program intervention strategies to reduce or remove these barriers include providing training, education and information at the point-of-purchase, and advertising, and financial incentives to midstream market actors (including distributors, retailers, building performance contractors, remodelers, homebuilders and lighting designers and specifiers) in order to increase consumer purchases of energy efficient products. All of the residential energy efficiency programs, including the Appliances and Lighting program, are designed to increase consumer awareness of energy-efficient (including ENERGY STAR<sup>®</sup>) products and services, increase

product availability, reduce hassle costs, increase consumer confidence in these products and assist with deployment of new technologies.

The ENERGY STAR® Awareness Campaign includes television and print advertising to increase consumer awareness and understanding of the ENERGY STAR® logo and products. These complementary supply-side and demand-side initiatives are working together to increase consumer demand for energy-efficient products and services by:

- Providing information about energy-efficient products and services to increase awareness;
- Increasing consumer confidence in the reliability and quality of energy-efficient products and services;
- Helping to ensure that energy-efficient products and services are readily available to consumers in the marketplace;
- Providing opportunities for acceptance and promotion of energy efficiency products and services by midstream actors.

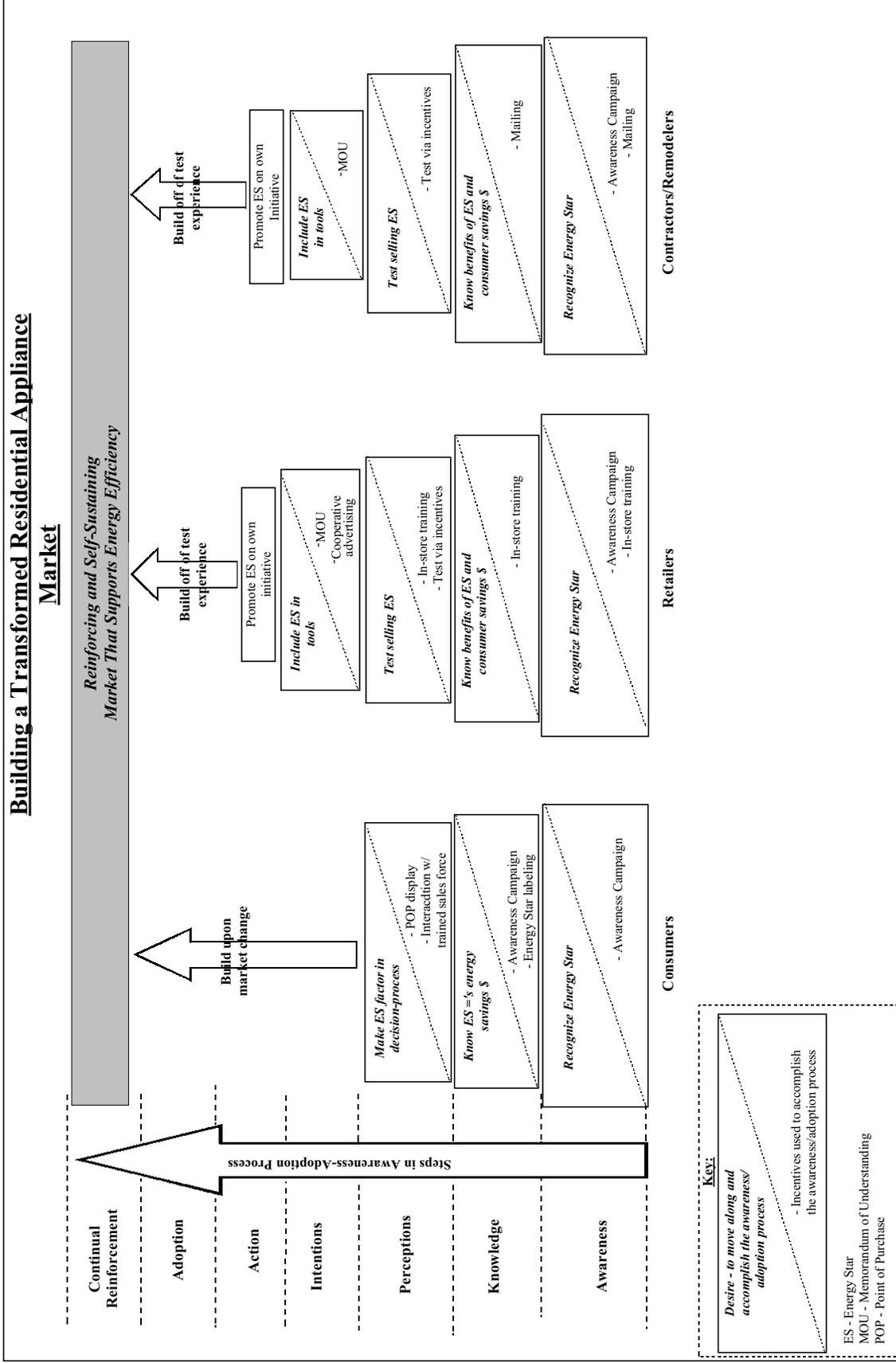
These linkages between intervention strategies targeted to specific market barriers for the various market actors is illustrated in Table 3-2. For example, one of the most important market barriers to retailers is market uncertainties and market search costs (column two in Table 3-2). This barrier is addressed through intervention strategies such as the ENERGY STAR® Awareness Campaign, point-of-purchase displays in retail stores, in-store training, as well as cooperative advertising. A short-term mitigation of this barrier is through the implementation of midstream incentives, as identified in Table 3-2. An illustrative example of how these strategies are used to address market barriers in the various sectors in a way that builds a transformed market, as discussed earlier, is provided below in Figure 3-3. Finally, Table 3-3 displays an overview of the **New York Energy Smart<sup>SM</sup>** program interventions that influence the residential sector along with the barriers they address, market actors they serve, and intervention strategy used. Greater detail on the ENERGY STAR® Appliance and Lighting and ENERGY STAR® Awareness Campaign is provided in Section 6 of this report.

**TABLE 3-2: Market Actors, Barriers, and Interventions in the Residential Appliance & Lighting Market**

Market Participants	Market Barriers							Intervention Strategies				
	Perf. Uncertainties/ Perf. Search Costs.	Market Uncertainties/ Market Search Costs.	Few Labeled Energy Star Products.	Low Perceived Value Versus Initial Higher 1st Cost.	Awareness.	Knowledge of Savings and Lifetime Benefits.	Energy Star Awareness Campaign.	Recruit Partners (MOU) and Cooperative Advertising.	Point-of- Purchase (POP) Displays.	In-Store Training.	Partners Increase Energy Star Labeling & % of Stock.	Mid-stream incentives.
Retailers		XXX					X	XX	XX		ST	
			XXX					XX	XX	XXX	ST	
				X	XXX		X	XX	XXX	XXX	X	
Contractors/ Remodelers						XX			XX	XXX		
	XX	XXX					X	X			ST	XX
			XX	X						XX	ST	X
Consumers					XXX		X	XX			X	XXX
	X					XXX				XX		XXX
			XXX	XXX			X			XX		XXX
										XXX		X*
				XXX			XX		X*	X		X*
					XX		X	X	XX*	X		X*

**Key:**  
 XXX = Most Important  
 XX = Important  
 X = Significant  
 ST = short-term/immulation  
 \* = If mid-stream actions promote

**FIGURE 3-3: Intervention Strategies in the Residential Appliance and Lighting Market**



**TABLE 3-3: New York Energy Smart<sup>SM</sup> Residential Programs**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<b>Residential Appliances and Lighting</b>  <u>Total Budget:</u> \$8.5 million	Households and consumers.	Midstream: Retailers, remodelers, manufactured home dealers, distributors, vendors.  Down-stream: end-consumers.	<ul style="list-style-type: none"> <li>• Lack of information and awareness among consumers;</li> <li>• Lack of information and awareness of the reasons for buying energy-efficient products among retail salespeople;</li> <li>• Low stocking of energy-efficient products in retail stores;</li> <li>• Consumers place low value on energy-efficient products compared to their costs.</li> </ul>	These programs work in parallel to increase awareness and understanding of the ENERGY STAR <sup>®</sup> logo, and to increase sales of labeled products.  The Public Awareness program provides information to enhance public awareness of the ENERGY STAR <sup>®</sup> program and products through marketing and outreach multi-media campaigns, including Public Service Announcements (PSAs) like the <i>Lawnmower</i> and <i>Socket Boy</i> PSAs.  The Appliances and Lighting program recruits and trains New York ENERGY STAR <sup>®</sup> partners and provides in-store sales assistance, including labels and point-of-purchase (POP) displays to partners. This program is in the process of developing and implementing a \$3 million incentive program for New York ENERGY STAR <sup>®</sup> partners.
<b>ENERGY STAR<sup>®</sup> Public Awareness</b>  <u>Total Budget:</u> \$8.3 million				
<b>Home Improvement Loan Program</b>  <u>Total Budget:</u> \$2.0 million	Home improvement, retrofit, remodeling. Home-loan and financing market.	Home owners, banks, loan officers, lending institutions.	<ul style="list-style-type: none"> <li>• Lack of financing available in the marketplace offered to home owners for energy efficiency improvements.</li> <li>• Lack of information and awareness among banks and other lending institutions on how to calculate energy savings and evaluate risk from energy efficiency improvements.</li> </ul>	Provides unsecured loans to home owners for projects that incorporate ENERGY STAR <sup>®</sup> products and renewable technologies. Through the federal Fannie Mae Residential Energy Efficiency Financing Program, unsecured loans up to \$20,000 will be provided to single family homeowners for home improvements including energy efficiency measures. The Fannie Mae loan product will be offered through qualified contractors. A total of \$2 million is available for this program, the majority of which will be used to buy-down or decrease the interest rate on Fannie Mae loans.

**TABLE 3-3: New York Energy Smart<sup>SM</sup> Residential Programs (Continued)**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<p><b>Residential New Construction</b></p> <p>Total Budget: \$2.4 million</p>	<p>New home construction (new build)</p>	<p>Contractors and builders.</p>	<ul style="list-style-type: none"> <li>Limited number of financing options for energy efficiency improvements and designs.</li> <li>Lack of information and awareness on where to find information regarding energy efficiency in new construction design.</li> <li>Lack of trained installers, contractors, and builders in the residential new construction market who regard energy efficiency as a value-added measure.</li> </ul>	<p>This program provides financial incentives and technical assistance to one-to-four family home builders to encourage the adoption of energy-efficient design features and the selection and installation of more energy-efficient equipment in new construction, and substantial renovation projects.</p>
<p><b>Residential Building Performance Market Enhancement</b></p> <p>Total Budget: \$7.0 million</p>	<p>1-4 family households.</p>	<p>Building performance contractors; HVAC contractors; Trade associations; Insulation contractors; Remodelers; Home energy raters; 1-4 family households, and building owners.</p>	<ul style="list-style-type: none"> <li>Lack of information available to consumers and mid-market actors (contractors, remodelers, energy raters, etc.) regarding energy efficiency services.</li> <li>Consumers associate risk with hiring a reputable contractor, remodeler, energy rater, etc. who can provide energy efficiency services.</li> </ul>	<p>The purpose of this program is to facilitate growth of the nascent building performance industry in New York State. This program will be coordinated by the Consulting Division of the Conservation Services Group, Inc. (CSG) whose has the primary responsibility of providing technical and consulting services to customers (government agencies, utilities, housing authorities, and others) who need assistance in designing strategies to serve their energy efficiency needs. The contractor will assess the current building performance market (e.g. establish a baseline for the existing building performance market by providing a draft Market Survey of four geographic regions of New York - Buffalo, Syracuse, Binghamton, and the Capital District); design a program incentive structure (e.g. develop strategies to supplement outside incentive funding with market based incentives and industry funded incentives); design the qualifying process for program eligibility; implement the program; enroll participants; coordinate with other Energy Smart activities; train and qualify participants; validate measures installed and quality of workmanship; collect data on services rendered; collect data on energy usage; and report findings.</p>

**TABLE 3-3: New York Energy Smart<sup>SM</sup> Residential Program (Continued)**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<p><b>Innovative Opportunities: Residential</b></p> <p><u>Total Budget:</u> \$0.82 million</p>	<p>Manufacturers, dealers, retailers and customers.</p>	<p>Midstream and Upstream market actors including: manufacturers, retailers, as well as end-use consumers.</p>	<ul style="list-style-type: none"> <li>Lack of information on energy-efficient products.</li> <li>Limited awareness on how to value energy efficiency improvements.</li> </ul>	<p>Through the competitive solicitation of six projects this program provides information, outreach and training, and access to technology to increase the availability, promotion, and sale of energy-efficient products and services. This program also assesses market barriers to energy-efficiency and offers recommendations to overcome these barriers. The six projects administered by this program are:</p> <ul style="list-style-type: none"> <li>Market Assessment of Coin-Operated Washing Machines in New York City,</li> <li>Residential Software Demonstration,</li> <li>Development of Dispute Resolution Procedures for Submetered Cooperatives,</li> <li>Policy Research on Submetering</li> <li>Developing the Market for Whole-House Energy Services, and</li> <li>Increasing the Availability of Residential Building Science Training.</li> </ul>
<p><b>Residential Comprehensive Energy Management Services</b></p> <p><u>Total Budget:</u> \$2.5 million</p>	<p>Households.</p>	<p>Single family and multifamily customers.</p>	<ul style="list-style-type: none"> <li>High first cost of energy management and advanced metering systems.</li> <li>Lack of customer knowledge regarding the benefits as well as how to install energy management and metering systems.</li> </ul>	<p>Provides incentives to owners of 3,000 single-family homes and 300 multifamily buildings to reduce the expense of advanced metering systems.</p>
<p><b>Loan Fund Multifamily Building Demonstration</b></p> <p><u>Total Budget:</u> \$1.0 million</p>	<p>Multifamily buildings.</p>	<p>Lending institutions, multi-family building owners.</p>	<ul style="list-style-type: none"> <li>Banking and lending institutions have not been able to place value on energy savings in the past.</li> <li>Banking and lending institutions lack the necessary information to assess energy savings created by energy efficiency improvements.</li> <li>Perceived risk by lending institutions.</li> </ul>	<p>Allocate \$1 million to support the implementation of comprehensive energy efficiency retrofits in publicly-assisted, weatherization eligible, and other hard-to-finance buildings that have a high potential for energy savings. Provide guaranteed energy efficiency improvement loans to support a pilot test of a financing model developed under NYSERDA's Weatherization Financing Partnership Project. This program expects to provide a loan product which makes energy efficiency improvements a valued monetized commodity and recognizes energy savings projections in the approval and underwriting processes.</p>

## **Low-Income Sector and Energy Efficiency Deployment Initiatives**

More than 1.8 million New Yorkers live below 125% of the poverty level, with nearly forty percent of these individuals receiving some form of public housing or energy assistance. The private housing stock for low-income residents is generally in poor physical condition and energy inefficient. Much of New York's publicly assisted housing has unusually high energy costs due to the use of electric resistance heat in inadequately insulated and weatherized buildings. Between \$500 million and \$1 billion in public funds are spent annually to meet a portion of the energy needs of low-income households, representing less than 25% of the \$4 billion spent on energy annually by low-income households in New York.

### Barriers to Improving Energy-Efficiency in the Low-Income Sector

Several market-based barriers exist within the low-income sector of the State that inhibit the awareness, knowledge, and adoption of energy-efficient products and services in this sector. These barriers have been identified as:<sup>19</sup>

1. A reluctance and or inability to pay or finance investments (and support loan repayments) in energy-efficiency, even on an interest-free basis among low-income households. (The **New York Energy Smart**<sup>SM</sup> Technical Assistance for Low-Income Publicly-Assisted Housing as well as Loan Fund Programs are currently developing measures to help alleviate some of the financial and technical burden caused by this barrier.)
2. Lack of energy-efficiency service providers and programs to effectively deliver assistance to dispersed rural populations.
3. Low-income households require high returns on investments compared to general residential households due to the competing demands being placed on limited income. Low-income households generally require pay-backs of less than one year for energy-efficiency investments compared to general residential households which require a payback period of roughly three years.
4. Low-income households do not receive any of the increased value associated with the property, and, in fact, may face rent hikes as a result of energy efficiency improvements. Large numbers of the low-income population tend to live in rental dwellings and have little incentive to improve their landlord's property. Along these same lines, rent-control requirements limit the ability of landlords to pass on the cost of energy-efficiency improvements to their tenants.
5. Insufficient tenure for low-income residents at a particular address often occurs - reducing the ability to cost-justify energy-efficiency and building improvements. Nearly 25% of the low-income population moves to a new residence each year. In order for an energy efficiency

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<sup>19</sup> New York State Energy Plan: Volume II - Issue Reports. October 1994. Issue 5, *Public Housing and Low-Income Energy Efficiency*.

investment to be cost-effective to the tenant, tenants must reside at their residences for the duration of the payback period.

6. Building owners have little incentive to invest in conservation improvements on their tenant's behalf. There are few financial benefits for landlords to invest in energy conservation measures in households which are individually metered and in which tenants pay their own electric bill directly to the utility.
7. Little incentive exists in master-metered buildings to use energy more efficiently. Master-metered buildings do not individually monitor a household's electricity consumption and, therefore, tenants have little incentive to alter their behavior to efficiently use electricity.

### Intervention Strategies and the Low-Income Sector

The combination of poor housing stock, high energy costs, and New York's cold climate make it difficult for low-income households to afford to pay energy bills. The **New York Energy Smart<sup>SM</sup>** program supports intervention strategies for low-income customers addresses a number of barriers including:

- Helping more than 8,000 households lower their electric bill 25-30% by incorporating electric-reduction measures in the Weatherization Assistance Program (WAP).
- Supporting market-based strategies coupled with energy efficiency to help low-income consumers participate in emerging deregulated energy markets and to lower household energy costs. This includes creating permanent community-based mechanisms to facilitate low-income customer awareness and access to the competitive energy marketplace.
- Establishing close coordination with public housing entities to reduce taxpayer costs for energy use and improving the affordability of household energy for those living in publicly assisted housing.

The individual intervention efforts of the **New York Energy Smart<sup>SM</sup>** Low-Income programs addressing these market barriers are highlighted in Table 3-4. This table also identifies the market actors served by the programs. Additional information on low-income interventions is provided in Section 6 and 7 of this report. Section 6 provides information on individual program design and progress. Section 7 is a collection of six case studies including the **New York Energy Smart<sup>SM</sup>** Direct Installation case study. This case study provides background information on the program and reports initial program outcomes and success indicators.

**TABLE 3-4: New York Energy Smart<sup>SM</sup> Low-Income Programs**

<b>New York Energy Smart<sup>SM</sup> Program</b>	<b>Market Sector of Influence</b>	<b>Targeted Market Actors</b>	<b>Market Barriers Addressed</b>	<b>Intervention Strategy Employed</b>
<p><b>Technical Assistance for Low-Income Publicly-Assisted Housing</b></p> <p>Total Budget: \$790,000</p>	<p>Low-income residential households in the service territories of Central Hudson Gas and Electric Corporation, Orange and Rockland Utilities, Inc., and Consolidated Edison Company of New York.</p>	<p>U.S. Department of Housing and Urban Development (HUD); City and State assisted housing projects; Low-income cooperatives; Low-income residential households.</p>	<ul style="list-style-type: none"> <li>Organizational practices that do not support (or are not set up to support) energy efficiency.</li> <li>Higher first cost of energy-efficient technologies.</li> <li>Limited financial resources.</li> </ul>	<p>This program will initiate a series of pilot projects to incorporate design, selection, and installation of energy-efficient equipment into the State's portfolio of publicly-assisted housing. Pilot projects may include initiatives such as:</p> <ul style="list-style-type: none"> <li>the use of new replacement technologies for electric resistance heat;</li> <li>mechanics responsible for large heating plants;</li> <li>the bulk purchase of energy-efficient appliances; and</li> <li>innovative financing mechanisms to fund energy efficiency improvements.</li> </ul>
<p><b>Low-Income Direct Installation Program</b></p> <p>Total Budget:</p>				

**TABLE 3-4: New York Energy Smart<sup>SM</sup> Low-Income Programs (Continued)**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<p><b>Affordable Assisted Housing</b></p> <p>Total Budget: \$3.0 million</p>	<p>Low-income residential households in the service territories of Central Hudson Gas and Electric Corporation, Orange and Rockland Utilities, Inc., and Consolidated Edison Company of New York..</p>	<p>Low-income households, multi-family building owners.</p>	<ul style="list-style-type: none"> <li>Lack of product availability. Limited financial resources. Lack of familiarity with technical information.</li> </ul>	<p>Provides electric savings measures including energy -efficient lighting, appliances, and electric-to-gas fuel conversions to low-income customers.</p>
<p><b>Low-Income Public Awareness</b></p> <p>Total Budget: \$775,000</p>	<p>Low-income residential households in the service territories of Central Hudson Gas and Electric, Orange and Rockland Utilities, and Consolidated Edison Company of New York.</p>	<p>Low-income households, multi-family building owners.</p>	<ul style="list-style-type: none"> <li>Lack of information available to low-income persons on energy and efficiency choices and services.</li> </ul>	<p>Provides consumer energy education and referrals to existing credit/budget counseling services. Also supports ongoing Low-Income Forum on Energy (LIFE) process, especially the public awareness activities of the LIFE Communications and Outreach Committee. Educates and informs low-income persons as well as State and community-based service providers about services available to them under the low-income energy efficiency programs provided by NYSERDA.</p>

## **Commercial and Industrial Sector (Lighting, Cooling, and Motors)**

This section presents information on three markets within the commercial sector: commercial lighting, cooling (HVAC), and motors. Each market is described according to its structure, actor networks, and barriers. The **New York Energy Smart<sup>SM</sup>** program intervention strategies used to address these markets and barriers are also described. This section concludes with a display all of the **New York Energy Smart<sup>SM</sup>** program efforts that target the commercial and industrial sectors including the market actors and barriers targeted by each program, as well as the intervention strategy employed to address these actors and barriers.

### **Commercial Lighting Market**

The commercial sector of New York State accounts for 48% of electricity consumption while the industrial sector contributes another 20% for a total contribution of close to 70% of total statewide electricity use. Lighting accounts for over one-half of the electricity use in New York's commercial sector. Therefore, improving lighting efficiency is critical to the **New York Energy Smart<sup>SM</sup>** program strategy. The lighting product flow summarized in Figure 3-4 helps to explain how this market functions.<sup>20</sup>

#### **Market Actors in the Commercial Lighting Market**

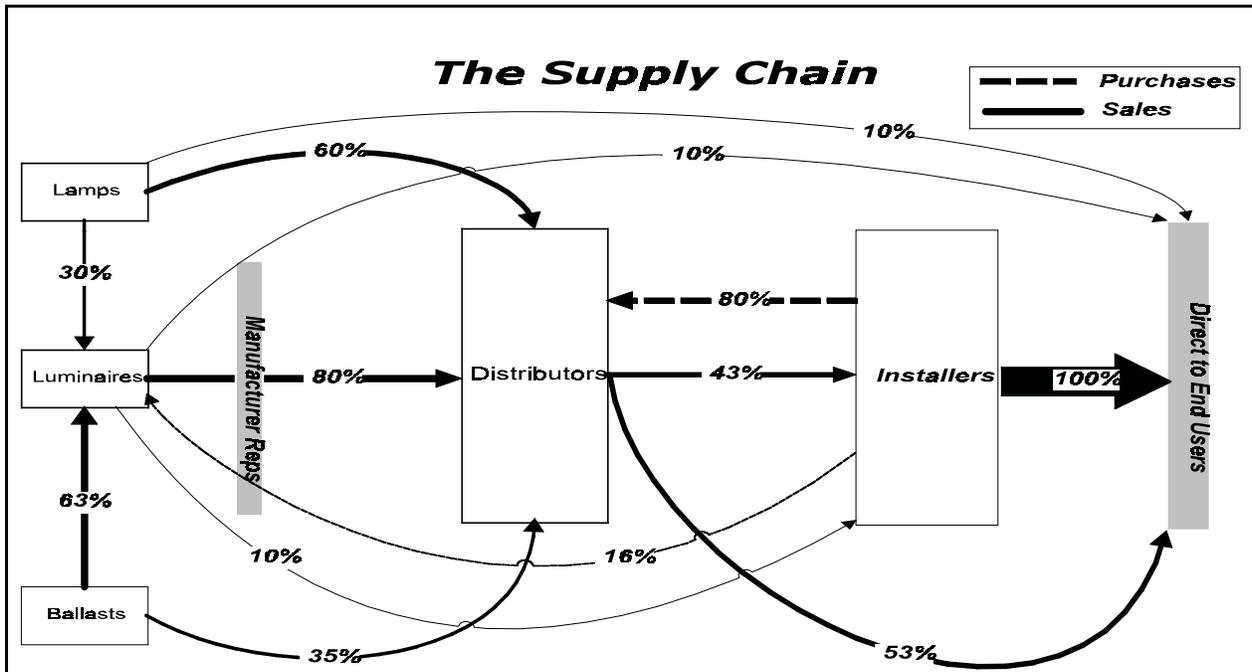
There are several different market actors that influence commercial lighting decisions, including manufacturers, electrical contractors, retailers and suppliers, designers, architects and consultants, and end-users, each having their different interests. Manufacturers, design, manufacture, and market lighting products, replacement accessories, etc., with marketing representatives promoting and selling lighting products to midstream market participants. Electrical contractors work directly with commercial and end-use customers to make lighting choices and install lighting products. Lighting retailers and suppliers sell lighting equipment to contractors and end-users. Lighting designers, architects, and consultants, provide actionable recommendations regarding lighting configurations, particularly at small commercial offices or retail establishments, without doing installation work. Finally, end-users typically make the lighting choices for commercial establishments (*e.g.* retail chain stores). A draft market assessment and baseline study of the commercial lighting market was conducted by Opinion Dynamics Corporation.<sup>21</sup>

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<sup>20</sup> A large market effects study was conducted a few years ago by Xenergy for Pacific Gas and Electric Company (PG&E) and San Diego Gas and Electric Company (SDG&E). This work included providing estimates of the size and interaction of the various levels of market actors in the commercial lighting market.

<sup>21</sup> Opinion Dynamics Corporation. June 2000. *High Quality, Energy-Efficient Lighting Market Assessment and Baseline Study DRAFT*. ODC #5137.

**FIGURE 3-4: National Commercial Lighting Product Flow**



Source: PG&E and SDG&E Commercial Lighting Market Effects Study, Volume 1, by Xenergy, Inc. with Easton Consultants.

The study focused on the awareness, installation, and market presence of high quality energy-efficient lighting. Consistent with the significance mid-market actors have as primary influences on market events (discussed earlier), draft results of the study show architects are one of the most influential market actors in the high-quality energy-efficient lighting market. Architects were regarded as the lead market influence for the installation and or lighting design (equipment use and layout) for retail chain stores, non-retail chain stores, and office space. General contractors and lighting designers were also identified as playing influential roles within this market.

Barriers in the Commercial Lighting Market

The following market barriers were identified by the ODC study as influential to electrical contractors with regard to high quality energy efficient lighting design and recommendations. These barriers have been ranked in order of importance according to electrical contractors responses.

1. Initial construction and installation costs. (26% of survey sample)
2. Initial design costs. (24%)
3. Product availability (for replacement parts and bulbs) (17%).
4. Lack of additional profit to justify additional risk or effort for installation. (14%)
5. Lack of experts in high-quality energy-efficient lighting. (13%)

6. Risk associated with choosing and installing high-quality energy-efficient lighting. (11%)
7. Lack of customer awareness of the benefits of high-quality energy-efficient lighting. (11%)
8. Lack of customer belief in indirect benefits of high-quality energy-efficient lighting (*e.g.* improved productivity, sales, etc.)

The following five factors are considered the most important to lighting contractors when designing a lighting layout for a retail or office space:

1. Lumen output, representing the amount of light on a surface area (43% of survey sample regarded this as most important).
- 2.. Reduced energy costs (43%)
3. Lower operation/maintenance costs (42%)
4. Aiming flexibility of accent lighting (30%)
5. Direct glare and reflected glare (29%)
6. Color rendering index and temperature (27%)

#### Intervention Strategies and the Commercial Lighting Market

The **New York Energy Smart<sup>SM</sup>** Small Commercial Lighting program has been designed to demonstrate the benefits of high-quality energy-efficient lighting services to medium-sized commercial spaces with less than 10,000 square feet of space. The program, with funding of \$3.8 million, is designed to:

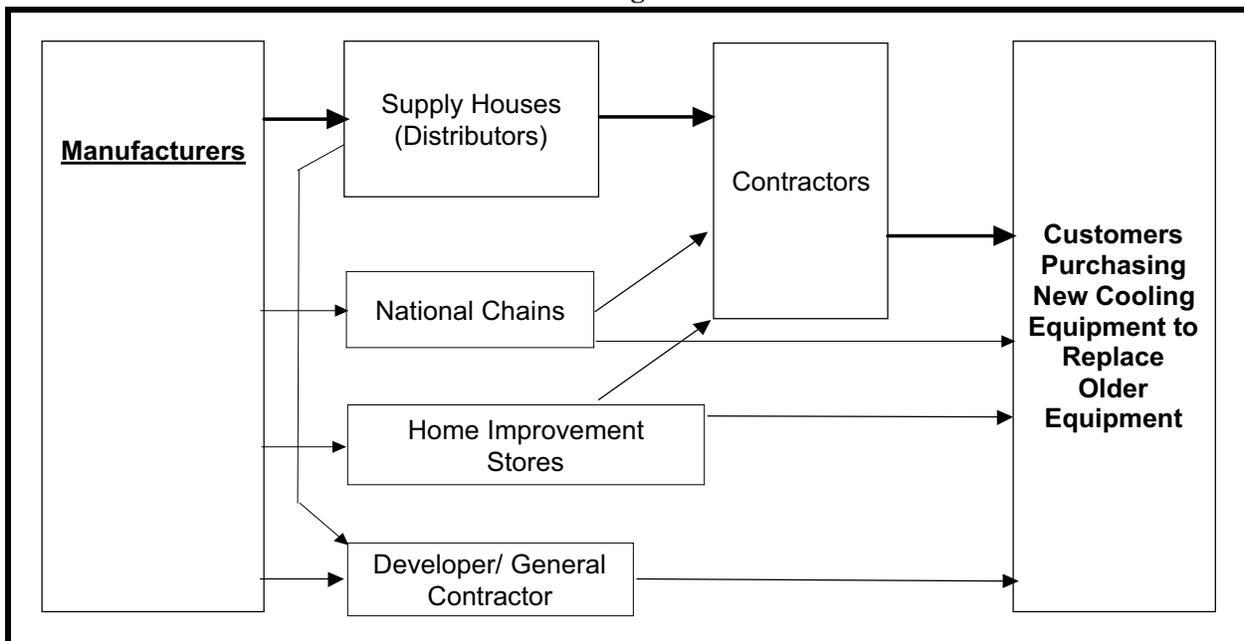
- Increase the knowledge of electrical contractors, lighting suppliers, and retailers regarding high-quality energy-efficient lighting;
- Increase the availability of customer promotional materials on high-quality energy-efficient commercial lighting;
- Influence lighting decisions for approximately 50 million square feet of commercial building space; and
- Achieve 138,000 megawatt hours of annual electric energy savings.

The program has been operational since March 2000 with ICF Consulting as its primary program implementation contractor. Sub-contractors for the program include Opinion Dynamics Corporation (ODC), the Lighting Research Center, Consolidated Edison Company of New York, Inc., and Honeywell DMC Services. ODC has already conducted market assessment and baseline research and prepared a draft report with the initial findings reported earlier. A final market assessment and baseline data are expected by year-end.

## The Commercial Cooling Retrofit Market

Retrofit cooling equipment markets, for all sectors, are generally characterized by the market actor and flows depicted in Figure 3-5. The biggest distinguishing factor between the residential retrofit cooling market and the commercial and industrial (C/I) retrofit cooling market, is that the influence of market actors differs. Residential consumers rely more on national chains and home improvement stores for energy-efficient product information and purchases, while C/I markets receive similar services from contractors or directly from distributors. Similarly, the sales structure differs, with a greater proportion of contractor sales in the C/I markets going to developers and other contractors rather than to end-users or builders. Moreover, in the case of window air-conditioning units, residential sales are largely from national chains and home improvement stores, while the majority of central air-conditioning system sales are from contractors.

**FIGURE 3-5: Generic Product Flow of the Cooling Retrofit Market**



## Intervention Strategies and the Commercial Cooling Market

Two contractors are currently working through the **New York Energy Smart<sup>SM</sup>** HVAC program to characterize the commercial HVAC market. Responsibilities include identifying and evaluating target buildings and key market actors; developing the program design; and assessing market structure, behaviors, and barriers. Within these major tasks the contractors will provide multi-media outreach, and promotional and educational materials, and services (*i.e.*, creating a web-site to increase market actor accessibility to reliable information as well as equipment purchasing options). Through the efforts of the **New York Energy Smart<sup>SM</sup>** HVAC program, long-term substantial benefits including energy savings,

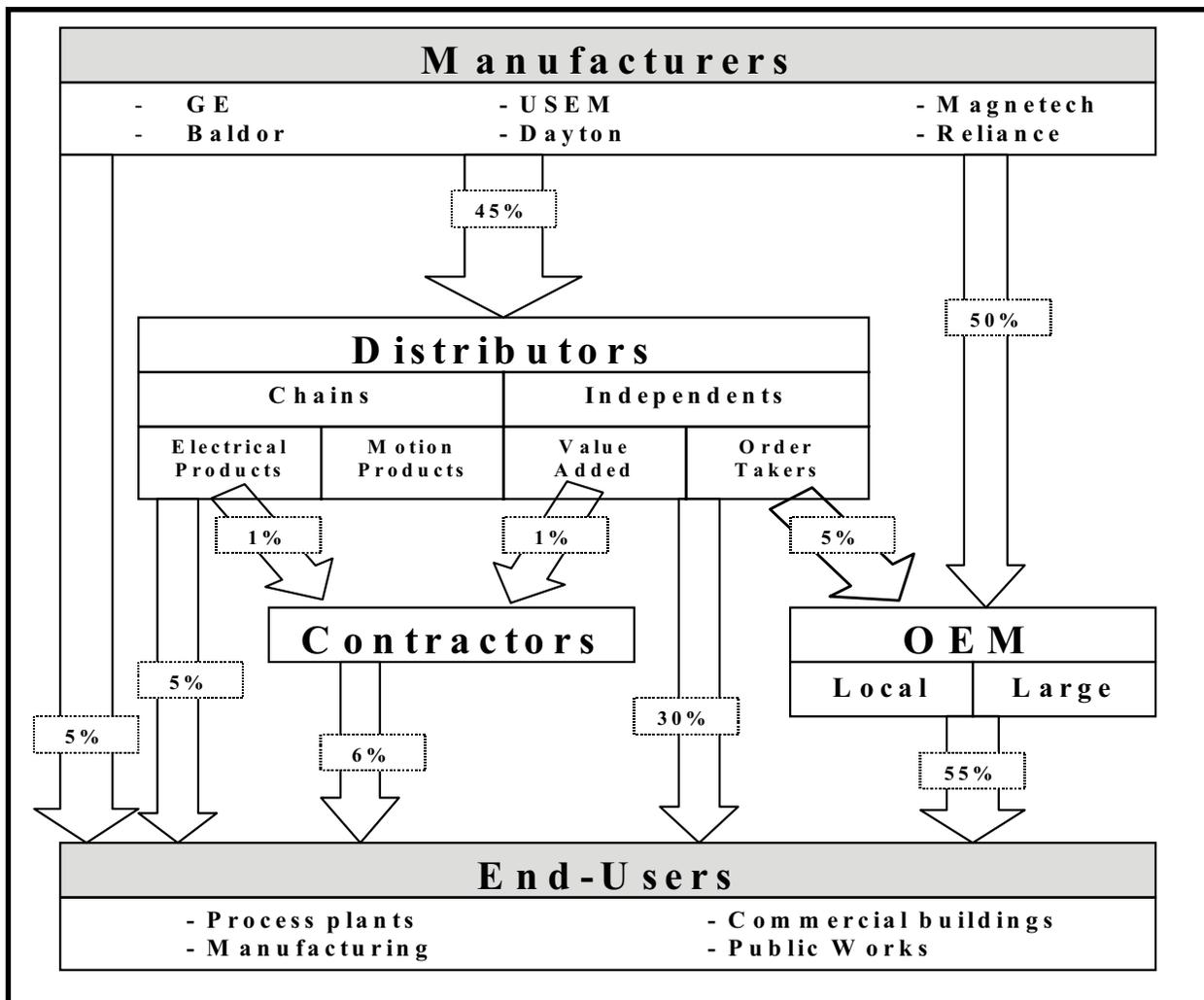
and reduction of peak electric demands are expected. In addition, the program intends to drive the HVAC market toward higher efficiency unitary HVAC equipment on a sustainable basis.

**Commercial Motors Market**

Commercial Motors and Market Structure

NYSERDA is a member of the Northeast Energy Efficiency Partnership (NEEP), which conducted a study of the Northeast motors market as part of the **New York Energy Smart<sup>SM</sup>** program implementation. The market structure defined through market research is depicted in Figure 3-6.

**FIGURE 3-6: Market Flow of the Motors Market**



Source: Northeast Premium Motor Initiative Market Baseline and Transformation Assessment, conducted by Easton Consultants, Inc. with Xenergy, Inc. for NEEP; August 1999; page 8.

As shown in Figure 3-6, independent distributors play a large role, with a 30% market share of sales to end-users, while original equipment manufacturers contribute over a 50% share. Two-thirds of all motors sold in New York State are in the one to five horsepower range (HP). One-quarter of motors sold are between six and twenty horsepower. Larger motor (> 50 HP) sales represent less than 1.5% of total motor sales. In addition, these larger motors, due to cost, are more frequently rewound by end-users and put back into use, further postponing sales of newer and more energy-efficient motors.<sup>22</sup> There are approximately 210 motor distributors in the State that sell premium-efficient motors, as well as standard efficiency integral<sup>23</sup> motors. The greatest share of premium efficiency motor sales in the State are sold through distributors who routinely promote efficient motors on their added benefits to customers (e.g., energy savings). These distributors account for approximately 12% of all motor distributors in the State.

Sales of standard integral motors and premium efficiency motors in New York in 1998 are shown in Figure 3-7. Approximately 16% of the motors sold in New York in 1999 were premium efficiency motors.<sup>24</sup> During 1998, 70,000 standard motors and 11,000 premium efficiency motors were sold in New York.<sup>25</sup>

Barriers in the Motors Market. Like other product and service markets, the premium efficiency motors market has several market barriers. These barriers range from low end-user awareness of premium efficiency motors to low product stocking by motor vendors. Each of these barriers present opportunities for the design and implementation of carefully planned intervention strategies. Two recent reports identified market barriers inhibiting the purchase of premium efficiency motors in the Northeast, as being:<sup>26</sup>

1. Limited recognition of terms “premium efficiency” (11%), “high efficiency” (20%), “energy efficient” (20%), or Energy Policy Act (EPAct), National Electrical Manufacturers Association

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<sup>22</sup> Easton Consultants, Inc. and Xenergy, Inc. August 17, 1999. *Northeast Premium Motor Initiative Market Baseline and Transformation Assessment*.

<sup>23</sup> Integral is a classification term that identifies a motor according to its size. Integral motors are 1 horsepower (hp) or greater. The **New York Energy Smart<sup>SM</sup>** Premium Efficiency Motors program offers incentives for the sale of premium efficiency motors between 1 - 200hp.

<sup>24</sup> Of the 11,000 premium efficiency motors sold in New York State in 1999, 12% were CEE-qualified premium-efficient motors. These motors represent the focus of the **New York Energy Smart<sup>SM</sup>** Premium Efficiency Motors Program.

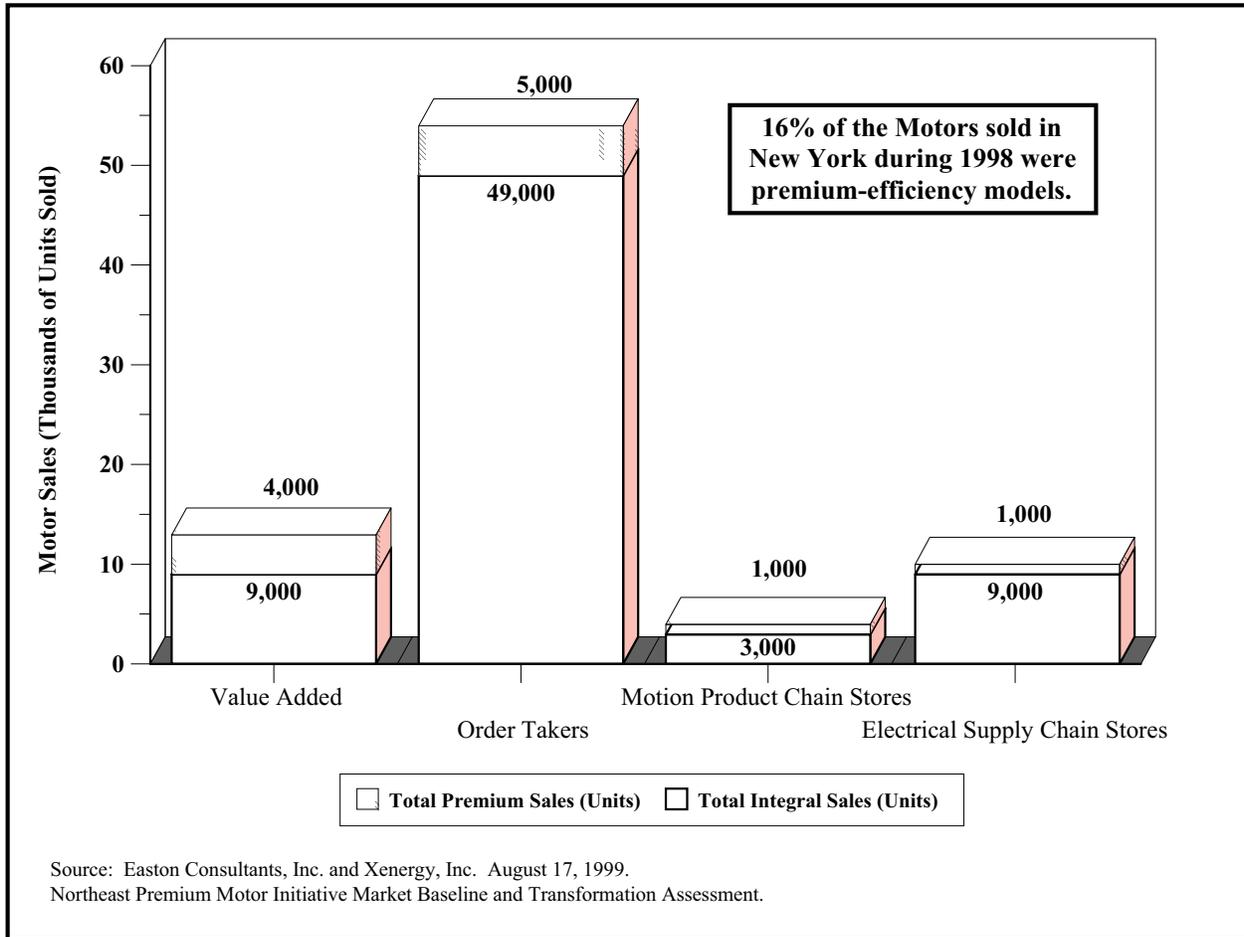
<sup>25</sup> *Premium Motor Initiative Market Baseline and Transformation Assessment*. August 1999. Easton Consultants, Inc. and Xenergy, Inc.

<sup>26</sup> The two reports are (1) Easton Consultants, Inc. and Xenergy, Inc. August 17, 1999. *Northeast Premium Motor Initiative Market Baseline and Transformation Assessment*, and (2) Consortium for Energy Efficiency, *Consortium for Energy Efficiency Premium Efficiency Motors Initiative*, August 1996.

(NEMA), and U.S. DOE (8%), and confusion among end-users of the correct definitions of the terminology describing energy-efficient motors. Forty-one percent of motor users do not recognize any of the above terms.

- Rewound motors appear to take precedence over new purchases of new higher-efficiency motors (90% of State motor users rewind motors “from time-to-time”).

**FIGURE 3-7: Comparing Sales of Premium Efficiency Motors to Standard Models in New York State, 1998.**



- Little formal benefit-cost analysis of premium versus standard motors is conducted. Low initial cost is a major decision factor in purchasing motors among customers. Premium efficiency motor list prices average 20% to 25% higher than comparable standard efficiency motors with the same characteristics. This differential varies by horsepower and by manufacturer. There is generally less price differential at higher horsepower levels.

4. Eighty-eight percent (88%) of State end-users surveyed reported that they had not heard of Motor Challenge.<sup>27</sup> Of the 12% who had heard of Motor Challenge, 94% do not use Motor Challenge materials. Eighty-nine percent (89%) of end-users surveyed had no recognition of MotorMaster, and of those that had heard of MotorMaster, 66% do not participate.
5. Low inventory stocking of premium efficiency motors in the State which may be attributable to the low awareness of premium-efficient motors by end-users. In addition, it may be extrapolated that low stocking, coupled with low awareness, contributes to low sales. However, premium-efficient motor stocking has increased by one-third in the past year (1999).

#### Intervention Strategy and the Commercial Motors Market

The **New York Energy Smart**<sup>SM</sup> Premium Efficiency Motors program is targeting midstream market actors, including motor vendors, dealers, and retailers to help mitigate and overcome market barriers. By offering financial incentives and information to midstream market actors for premium efficiency motor sales, the program attempts to make lasting changes in purchase decisions. The program seeks to increase the market share of CEE-qualified premium-efficient motors by 10%. More detail on this program and its success to date is provided in Section 6, and the Premium Efficiency Motors Case Study in Section 7 of this report.

#### Barriers in the Commercial and Industrial Sector

The primary end-uses of electricity in the commercial and industrial sectors are for lighting, ventilation, air-conditioning, and motors. Many of these products and their related services are found in markets common to both the commercial and industrial sectors. As a result, several of the **New York Energy Smart**<sup>SM</sup> program efforts offer services to both sectors simultaneously. These programs encourage energy service companies (ESCOs) to offer customers energy efficiency as a value-added service, as part of a broader strategy of helping to foster the energy services industry in New York. Developing the ESCO industry is critical to developing a midstream actor capability for helping overcome barriers to improved efficiency faced by commercial and industrial customers.

The Energy Center of Wisconsin and NYSERDA, in 1998, sponsored a market assessment of the ESCO industry to help market actors in both states better understand the industry and its potential for increasing

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<sup>27</sup> The Motor Challenge was created by the U.S. DOE to promote energy efficiency in industrial motor systems, and reduce greenhouse gas emissions, while helping companies compete more successfully. The program supplies unbiased information about motor systems design, purchase, and operation from experts. To achieve these ends, the program offers a network of resources including software, technical training and support. The Motor Challenge is administered by the U.S. DOE's Office of Industrial Technologies. The Motor Challenge is now part of the U.S. DOE's 'Best Practices' program which evaluates industrial energy consumption from a total systems perspective.

energy efficiency among energy users.<sup>28</sup> The report concluded that the three most critical market barriers facing potential ESCO customers (commercial and industrial organizations) include: performance uncertainty with high efficiency technologies; hassle and transaction costs; and high information and search costs.<sup>29</sup> A second report<sup>30</sup> found that: “generally, energy-efficiency is not a high priority for most industries. Process improvements are generally driven by other priorities, such as improved productivity, product quality, or environmental compliance. Industrial customers are especially risk-averse to changes to core processes within their operation because of perceptions that such changes could disrupt or adversely affect production and product output.”

### Intervention Strategies for the Commercial & Industrial Sectors

NYSERDA’s Energy Services Industry initiatives seek to address these market barriers through a variety of means, including the following, for each identified barrier.

Performance Uncertainty. The **New York Energy Smart**<sup>SM</sup> Institutional Energy Performance Contracting Assistance program reduces performance uncertainty by improving customer awareness and familiarity with the technology and process, and by sharing the financial risk involved in exploring the use of an energy performance contract. The Standard Performance Contract program provides customers with third-party verification that the savings estimates are reasonable.

Hassle and Transaction Costs. The **New York Energy Smart**<sup>SM</sup> Energy Services Industry initiatives reduce hassle and transaction costs by offering financial incentives to participants. Project costs are particularly high for smaller projects, and the Standard Performance Contract Program helps off-set these costs. In particular, the program offers 20% higher incentives to smaller customers as an added incentive.

Information and Search Costs. The **New York Energy Smart**<sup>SM</sup> Energy Services Industry initiatives help to develop interest in energy efficiency and energy performance contracting that energy service companies can use in their sales prospecting. The programs provide customers information on energy-efficiency from an independent, objective, and reliable source.

Table 3-5, below, displays **New York Energy Smart**<sup>SM</sup> program efforts that target the commercial and industrial sectors. Market actors and barriers targeted by each program, as well as the intervention strategy employed to address these actors and barriers is highlighted in this summary table.

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<sup>28</sup> Energy Center of Wisconsin. *Energy Services Companies, A Market Research Study*. April 1999.

<sup>29</sup> *Id.*, page 56.

<sup>30</sup> Energy Center of Wisconsin. *Industrial Process Efficiency Program Design, A Program Study*. July 1997. page ii.

**TABLE 3-5: New York Energy Smart<sup>SM</sup> Commercial and Industrial Programs**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<p><b>Premium Efficiency Motors Program</b></p> <p><u>Total Budget:</u> \$2.5 million</p>	<p>Commercial and industrial motor replacement.</p>	<p>Commercial motor vendors and distributors.</p>	<ul style="list-style-type: none"> <li>Lack of information, awareness, and technical expertise regarding premium efficiency motors among motor vendors and customers. This includes their ability to value energy efficiency as a value added measure.</li> <li>Consumers and vendors place low value on premium efficiency motor models.</li> <li>Low stocking level by midstream vendors. Low awareness of the energy and non-energy benefits associated with premium efficiency motor models.</li> </ul>	<p>Financial incentives, information, and marketing assistance targeted to midstream vendors.</p>
<p><b>New Construction</b></p> <p><u>Total Budget:</u> \$17.06 million</p>	<p>Commercial, Industrial, Institutional, Governmental, and Municipal</p>	<p>Building designers and architects; building engineers; commercial contractors and building owners.</p>	<ul style="list-style-type: none"> <li>Lack of knowledge/expertise in the C/I new construction market regarding energy-efficient design practices and technologies.</li> <li>High initial cost of energy efficiency measures perceived by building owners with uncertainty of payback or marketability of space.</li> <li>Lack of information and awareness regarding energy efficiency measures, energy savings by building owners/end-users causing them to place low value on installing such measures.</li> </ul>	<p>This program provides financial incentives to building owners and technical assistance to building designers, to encourage the incorporation of energy efficiency in new construction and substantial renovation of commercial buildings. Incentives totaling \$14.6 million are available to eligible building owners to offset between 50 to 70% of the incremental capital costs to purchase and install energy-efficient equipment and for building designs that reduce electric energy use. (Only electric energy efficiency measures are available to receive incentives.)</p>
<p><b>Innovative Opportunities: Commercial and Industrial</b></p> <p><u>Total Budget:</u> \$2.6 million</p>	<p>Commercial, Industrial, Institutional, and Municipal.</p>	<p>Institutional building managers; municipal decision makers; building architects and engineers; commercial appraisers and property investors.</p>	<ul style="list-style-type: none"> <li>Lack of customer access to information.</li> <li>Low awareness regarding energy efficiency technologies and upgrade possibilities available to customers.</li> <li>Limited financial resources among target market actors.</li> <li>Risk aversion.</li> </ul>	<p>Supports the creation of projects that increase the availability, promotion, and sale of energy-efficient products and services not addressed through other NYSEERDA market transformation programs.</p>

**TABLE 3-5: New York Energy Smart<sup>SM</sup> Commercial and Industrial Programs (Continued)**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<p><b>Small Commercial Lighting</b></p> <p>Total Budget: \$3.8 million</p>	<p>Commercial spaces less than or equal to 10,000 square feet in size.</p>	<p>Distributors, electrical contractors, lighting suppliers, and other lighting decision makers.</p>	<ul style="list-style-type: none"> <li>• Building owners do not place a high value on energy savings and non-energy benefits as a result of low-awareness, lack of information to make decisions, and organizational practices that may inhibit (or do not reward) the evaluation and installation of such measures.</li> <li>• Perceived market uncertainties by market actors.</li> <li>• Lack of access to information and technical expertise among lighting installers and contractors regarding energy efficiency.</li> </ul>	<p>This program will increase electrical contractor, lighting supplier, and retailer knowledge on high-quality energy-efficient lighting by using two pilot tests to evaluate various methods of influencing lighting design.</p> <p>The program will also increase the availability of customer promotional materials on high-quality energy-efficient lighting.</p>
<p><b>Commercial HVAC</b></p> <p>Total Budget: \$1.7 million</p>	<p>Commercial</p>	<p>HVAC installers and maintenance professionals. Commercial building energy managers/owners. Architects and engineers.</p>	<ul style="list-style-type: none"> <li>• Limited customer awareness and information on energy savings potential and other non-energy benefits.</li> <li>• Bounded rationality.</li> <li>• Organizational practices.</li> <li>• Lack of familiarity with designing, installing, maintaining, and servicing energy-efficient HVAC systems among installers and contractors.</li> <li>• C/I building owners/managers are faced with limited financial resources, products schedules that get priority over energy efficiency upgrades/needs, and internal organizational practices that do not reward energy efficiency efforts.</li> </ul>	<p>Design and implementation of 3 to 5 projects that will demonstrate and provide: aggregated procurement, increased product availability and promotion, improved installation practices, and commissioning of energy-efficient HVAC equipment.</p>

**TABLE 3-5: New York Energy Smart<sup>SM</sup> Commercial and Industrial Programs (Continued)**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<b>Standard Performance Contract</b>  Total Budget: \$33.5 million	Institutional, municipal, and commercial and industrial buildings.	Facility managers and building owners; ESCOs.	<ul style="list-style-type: none"> <li>• Lack of a sustainable market infrastructure for the delivery of energy efficiency services.</li> <li>• Slow emergence of competitive electric commodity market.</li> <li>• Economic barriers.</li> </ul>	Provides performance-based price incentives to be paid to energy service companies (ESCOs) for the delivery of energy efficiency products and equipment.
<b>Institutional Energy Performance Contracting Assistance</b>  Total Budget: \$3.25 million	Institutional (health care), school (K-12), municipal, and other educational building sector.	Institutional (health care), school (K-12), municipal, and other educational building managers and/or owners, customers.	<ul style="list-style-type: none"> <li>• Performance uncertainty.</li> <li>• Hassle and transaction costs.</li> <li>• Information and search costs.</li> <li>• Organizational practices.</li> </ul>	Shares financial risk with customers involved in exploring the use of an energy performance contract. This program will underwrite the customer costs of obtaining an audit (by paying half the cost of a comprehensive energy audit at customer facilities) and related costs associated with entering into a performance contract.
<b>Energy Audit Pilot Program</b>  Total Budget: \$0.3 million	Not-for-profit, institutional, multi-family, commercial, industrial, and government buildings.	Small facilities (less than \$100,000 in annual electric bills).	<ul style="list-style-type: none"> <li>• Lack of information, awareness, and technical expertise regarding how to conduct an energy audit.</li> <li>• Performance uncertainties.</li> </ul>	Provides information for energy decision-making, implementation of energy efficiency strategies, and achieving energy performance goals. Provides financial assistance for 300 energy audits. Assists customers with becoming ENERGY STAR <sup>®</sup> Small Business or ENERGY STAR <sup>®</sup> Building Partners.
<b>FlexTech</b>  Total Budget: \$3.5 million	Not-for-profit, institutional, multi-family, commercial, industrial, and government buildings.	Electricity customers located within the not-for-profit, institutional, government, business, and multi-family building sector.	<ul style="list-style-type: none"> <li>• Limited financial resources among facility owners.</li> <li>• Organizational practices that inhibit identifying and implementing energy efficiency improvements.</li> <li>• Lack of access to information.</li> <li>• Performance uncertainties.</li> </ul>	Provides technical information to customer facilities so that they can identify and obtain support for energy-efficient improvement measures. Provides funding for energy analysis studies to be performed.

**TABLE 3-5: New York Energy Smart<sup>SM</sup> Commercial and Industrial Programs (Continued)**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<p><b>Energy Feasibility Studies</b></p> <p>Total Budget: \$3.2 million</p>	<p>Not-for-profit, institutional, multi-family, commercial, industrial, and government buildings (retrofit/redesign).</p>	<p>Customers (owners/managers) of not-for-profit, institutional, multi-family, business (commercial/industrial), government buildings.</p>	<ul style="list-style-type: none"> <li>Lack of in-house technical expertise, information and awareness regarding energy efficiency improvements and designs.</li> <li>Production often gets priority over energy improvements due to risk/hassle associated and perceived with identifying energy efficiency improvements.</li> </ul>	<p>Provides technical information and expertise on a cost-shared basis. Also provides financial incentives for identifying industrial process improvements, waste minimization, and environmental performance opportunities.</p>
<p><b>Energy Operations Management</b></p> <p>Total Budget: \$1.9 million</p>	<p>Not-for-profit, institutional, multi-family, commercial, industrial, and government buildings.</p>	<p>Customers (owners/managers) of not-for-profit, institutional, multi-family, business (commercial/industrial), government buildings.</p>	<ul style="list-style-type: none"> <li>Lack of information and awareness regarding the benefits energy efficiency operational improvements provide.</li> <li>Production often gets priority over energy improvements due to risk/hassle associated and perceived with identifying energy efficiency improvements.</li> </ul>	<p>Provides funding for the development of baselines of energy use, energy planning, facility staff outreach and training, and commissioning of existing systems through the use of on-site energy management services and engineering analysis.</p>
<p><b>Rate Analysis and Aggregation</b></p> <p>Total Budget: \$1.0 million</p>	<p>Commercial, government, institutional, not-for-profit, multi-family, and industrial sectors.</p>	<p>Customers (electricity users and rate-payers) located in the institutional, government, not-for-profit, multi-family, and industrial sectors.</p>	<ul style="list-style-type: none"> <li>Lack of information and awareness on how deregulation is affecting consumer prices and energy and electricity options.</li> <li>Lack of information and awareness on how load management affects electric price opportunities.</li> </ul>	<p>Provides information on total electricity consumption and time of greatest use to consumers with intent that this information will better position customers to work with ESCOs and aggregators to obtain the best combination of cost-effective energy options to improve their efficiency of operations.</p>
<p><b>New York Energy Smart<sup>SM</sup> Loan Fund</b></p> <p>Total Budget: \$9.8 million</p>	<p>Banking and lending sector.</p>	<p>Lending institutions, loan officers, and any energy end user that can apply for a loan.</p>	<ul style="list-style-type: none"> <li>Perceived risk associated with offering energy efficiency low-interest financing by lending institutions.</li> <li>Lending institutions lack information and awareness on how to calculate energy savings from energy efficiency improvements.</li> </ul>	<p>Provides loan interest reductions on loans up to \$500,000 for up to 5-years.</p>

## **Research and Development Sector**

This section identifies the significance of R&D program funding in developing and fostering renewable investments in the wind, photovoltaic (PV), and biomass markets. Following an introduction, barriers to the growth of this industry are presented, followed by a summary of the residential PV market, and the **New York Energy Smart<sup>SM</sup>** program intervention strategies that target this sector and its associated barriers. This section concludes with a display all of the **New York Energy Smart<sup>SM</sup>** program efforts that target the renewables and R&D sectors. This summary display identifies market actors and barriers targeted by each program and lists the intervention strategy employed to address these actors and barriers.

## **Renewable Energy Initiatives**

### Value-Added Benefits Associated with Renewable Investments

Renewable energy sources and technologies create and offer many value-added products and opportunities for all market sectors. These benefits are seen in the reliability of energy supplies; enhanced environmental quality; sustainable development and use of resources; economic development and prosperity; and security of energy supplies. More specifically renewables create value-added benefits by:

- Providing clean and reliable sources of electricity (especially in times of circumstance and need - *i.e.*, providing PV-generated electricity during times of natural disaster)
- Creating less land, water, and air pollution. In addition, renewable resources and technologies have less environmental risk associated with their use compared to other electricity generation sources (*i.e.* nuclear, coal-fired combustion, etc.).
- Sustaining natural resources. Renewable energy sources are virtually non-depletable.
- Offering long-term pricing security. (Prices for renewable energy and technologies continue to decline with increased market penetration and use of these products and sources.)
- Expanding job markets and localized economic activity. (Renewable energy systems have also been shown to create more jobs than conventional power plants.)
- Increasing security and reliability of energy sources and technologies. (If used as a distributed generation resource, renewable technologies can help to provide enhanced utilization of the power distribution system by off-setting peak load demands on a site-specific basis.)

### Renewables Market and Barriers

The major market barriers associated with renewable energy include the cost and performance of renewable energy technology. In addition, environmental impacts associated with large-scale wind farm

development and operation have also proven to be an obstacle. The focus of the **New York Energy Smart<sup>SM</sup>** renewable energy resources R&D effort is to stimulate creative and innovative companies to develop, manufacture and deploy sustainable and clean energy technologies and resources. Under this program, over 29 MW<sup>31</sup> of wind power, and over 1 MW of photovoltaic generation are being installed in New York State. This program area is also developing capacity to support markets for competitive bio-fuels and other products derived from bio-based plantations and feedstock. For example, through the **New York Energy Smart<sup>SM</sup>** Willow Plantation Development program, willow trees are being commercialized to become a value-added locally-produced source of renewable energy. This program seeks to optimize willow plantation production systems, develop producer interest in program participation, expand the biomass market for biomass fuels derived from willow trees, and mitigate environmental concerns about harvesting forests. In addition, the **New York Energy Smart<sup>SM</sup>** renewable energy resources program is actively:<sup>32</sup>

- Reducing barriers to installing PV by developing and disseminating information to potential end-users and other market participants, such as building code and insurance officials, that may support their development.
- Building and supporting New York's PV and wind system installation, maintenance, and service infrastructure through direct installation experience and training programs.
- Gaining experience with large-scale wind power plants connected to New York's electricity grid, and exploring and supporting strategies to create a green power market in New York.
- Developing new technology and value-added products to enable New York State manufacturers to serve the growing demand for renewable energy technology products.
- Investigating measures to reduce the cost of manufacturing renewable energy technologies and develop mechanisms to stimulate financing of these technologies through lending institutions and venture capital.

Advancements in solar and wind technologies continue to lower costs and increase reliability of using these technologies, resulting in expanding markets for both. These expanding industries provide opportunities for New York companies to develop and improve solar-electric and wind technologies and retail products to meet growing market needs. The **New York Energy Smart<sup>SM</sup>** program helps foster a sustainable industry by demonstrating and testing these technologies. NYSERDA's support for the development and commercialization of innovative and reliable products will assist in expanding State, national and international renewable energy markets.

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<sup>31</sup> The New York Energy Smart<sup>SM</sup> Renewable Energy program has 11.5 MW of wind power under construction and another 17.5 MW under negotiation. More information is provided in Section 6 of this report.

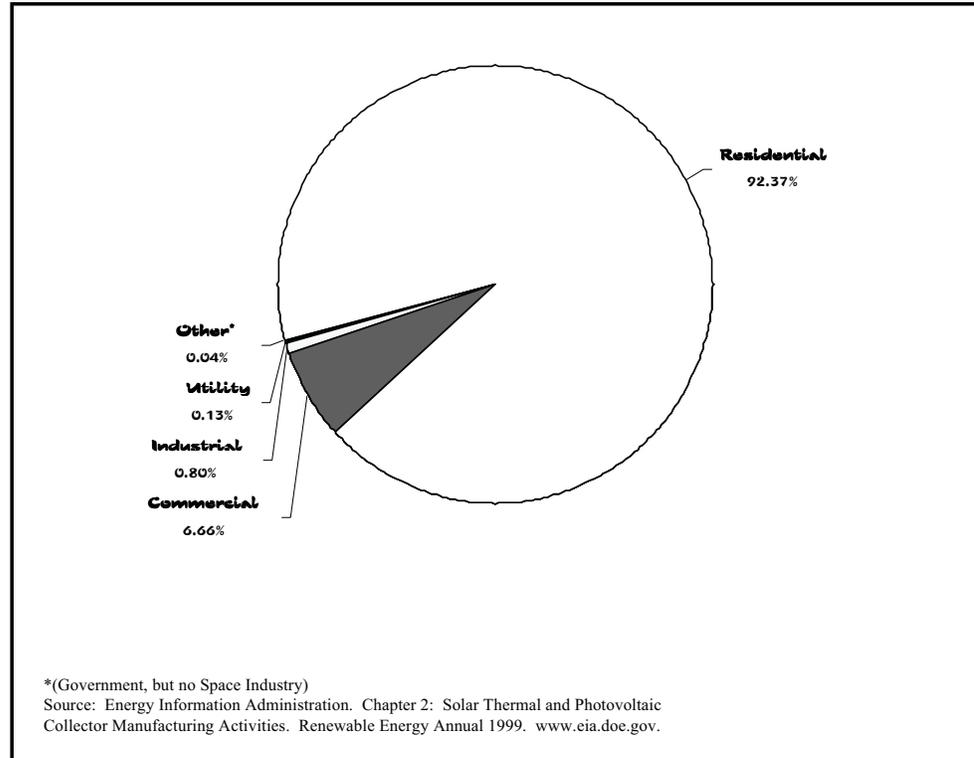
<sup>32</sup> NYSERDA: A Three-Year Plan for Energy Innovation, 2000-2003. *A Three-Year Plan for New York's Energy, Economic, and Environmental Future 2000-2003*. September 2000.

## Residential PV Market Structure and Functioning

The residential sector has the greatest percentage (92.4%) of solar collector shipments made each year, making it the fastest growing and largest market with regard to PV technologies, as illustrated in Figure 3-8. Although the technical limitations of photovoltaic technologies have been relatively well developed and understood by

engineers, their value-added properties and end-use potential has not yet been fully realized by the marketplace. The residential and commercial PV markets are young, and attract innovators and early adopters. These market actors, including multi-family building owners and single-family home owners, seek out PV installers and engineers for technical advice on products,

**FIGURE 3-8: Solar Collector Shipments by Market Sector, 1998.**



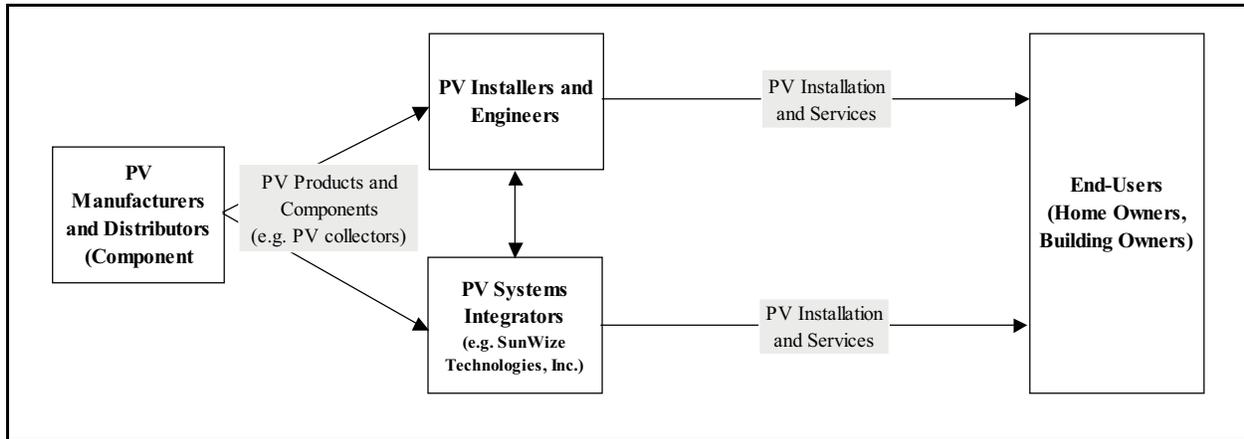
installation practices, and maintenance. These actors find value with PV systems and are willing to pay a price premium for the technology. These market actors may also already have an established network of technical providers, maintenance professionals, installers, and dealers whom they purchase PV products and obtain service from. Although market barriers such as those listed above place limitations on early adapters they do not constrain their decision-making process (decision to buy or not buy) as much as other market end-users. Although some early adopters install their own PV systems, very few home-owners who choose to invest in PV technologies are willing to design and install PV systems to meet their own individual needs. They leave this critical task to PV design engineers and installers who are the best suited technically to perform this function for the residential market.

The following four market actors influence the residential PV market in the commercial and industrial markets. Each actors function in the market is explained below, and Figure 3-9 provides a generic product and service flow for the residential PV market.

Manufacturing. Manufacturers specialize in designing and producing systems components such as PV collector cells, inverters, and other components.

Systems Integrators. These companies specialize in the design, manufacture, and marketing of integrated photovoltaic power systems. They generally purchase solar cells and components from manufacturers, configure them into value-added products, and then market, sell, and install them into specific market segments (e.g. residential homes, commercial buildings, specialized niche products - PV computer and cellular phone chargers).

**FIGURE 3-9: Generic Residential PV Market Product-Flow**



Dealers and Installers. PV dealers and installers are trained PV professionals who sell and install PV systems. They may also be system integrators. PV installers obtain their products directly from manufacturers, with no retailers serving as mid-market actors between installer and manufacturer in New York State. In the large commercial and industrial markets, in-house engineering staff or sub-contractors may serve as installers. This market may purchase products directly from manufacturers and configure them to their personal on-site needs. In the smaller commercial and residential markets installers and dealers sell, install, service, and monitor PV products and systems. With these smaller consumers, their presence is integral to the development of a sustainable infrastructure.

End-Users. Residential home-owners and commercial or industrial building-owners purchasing PV systems can significantly help drive the long-term growth of this industry. Depending on the type of end-user (e.g., large industrial or home owner) the level of awareness and expertise regarding PV systems varies. As a result, targeted marketing and outreach efforts will vary from one end-user to the next.

### Residential Photovoltaic Market Barriers

The residential photovoltaic (PV) market faces many barriers to development. These barriers are summarized into four categories: cost and financing; market infrastructure; awareness; and interconnection. Each is briefly discussed below.

Cost and Financing. Photovoltaic technologies have a high first cost. Additionally, the banking and lending institutions do not have well established mechanisms for valuing energy efficiency home improvements or technologies. This barrier is being addressed through the **New York Energy Smart<sup>SM</sup>** Residential PV program which provides installers with additional monies so that they may offer consumer rebates toward the purchase of PV systems.

Market Infrastructure. The PV market has an immature product and service infrastructure. New York has a small number of residential photovoltaic installers. Traditional building contractors are unfamiliar with PV technologies and generally do not offer it as a value-added product when offering products for end-users to choose from for home and building designs. The residential PV market is not well enough established to warrant directory services, such as being listed in telephone book yellow pages, to provide information and product support to home-owners.

Awareness. Currently the residential and commercial PV markets exhibit low awareness among consumers (residential households, commercial and industrial building-owners, government decision-makers, building appraisers, etc.) about photovoltaic technology, its costs, benefits and limitations, local solar resources, and assistance in selecting and evaluating bids to install their system. This is partially a result of a lack of information in the marketplace about PV technologies.

Interconnection. PV technology also faces difficulties interconnecting to the electricity grid (*i.e.*, inverters have only just begun to be type-tested to New York State standards; exit fees exist for some utilities; power purchase agreements between PV system owners and their utilities or energy service providers can be burdensome to understand) which limits the ability of the market to expand and become self-sustaining.

### Intervention Strategies and the PV Market

Through the **New York Energy Smart<sup>SM</sup>** Residential PV program, the photovoltaic market is slowly being transformed through the installation of grid-connected PV energy systems. This program supports companies throughout New York State who have an interest in marketing and installing PV technologies. By providing financial incentives to PV installers so that they can offer rebates to customers, the program is slowly helping to develop this market. One of the main components of this program is its relationship with mid-market actors such as installers. In order to receive incentives (up to 50% of the installation cost) the Residential PV program requires that these market actors monitor and report on all the PV systems they install for at least one year. Feedback from PV installers has helped the program to document the cost of installing and operating residential grid-connected PV systems. From these results the program will be able to show that these systems can be connected to the utility power grid and provide safe, reliable energy to residential consumers. Table 3-6, identifies market actors and barriers targeted by each **New York Energy Smart<sup>SM</sup>** Research and Development program effort and lists the intervention strategy used to address these actors and barriers. In addition to this summary, Section 6 provides greater detail into the breadth of **New York Energy Smart<sup>SM</sup>** R&D program intervention strategies.

**TABLE 3-6: New York Energy Smart<sup>SM</sup> Research and Development Programs**

<b>New York Energy Smart<sup>SM</sup> Program</b>	<b>Market Sector of Influence</b>	<b>Targeted Market Actors</b>	<b>Market Barriers Addressed</b>	<b>Intervention Strategy Employed</b>
<p><b>Energy Efficiency and Strategic Research and Development</b></p> <p>Total Budget: \$8.5 million</p>	<p>Electric end-use energy sectors (residential, commercial, industrial, municipal, institutional).</p>	<p>Electric end-use product manufacturers and users.</p>	<ul style="list-style-type: none"> <li>• Technical, economic and institutional barriers.</li> <li>• Market uncertainties.</li> </ul>	<p>Financial support provided to private companies to develop, demonstrate, and evaluate innovative electrical end-use technologies.</p>
<p><b>Environmental Monitoring, Evaluation and Protection</b></p> <p>Total Budget: \$7.1 million</p>	<p>Public policy and management; environmental and energy research and development.</p>	<p>Research scientists, public policy makers, government officials, the general public.</p>	<ul style="list-style-type: none"> <li>• Lack of market incentives to spur private investment in environmental monitoring and assessment.</li> <li>• Lack of adequate and objective environmental data available to policy decision-makers and the public.</li> <li>• Lack of monitoring to assess policy and regulation performance and success.</li> </ul>	<p>Provides funding support for technical and scientific energy and environmental research applications, monitoring, tools, modeling, and studies.</p>
<p><b>New York State Wind Power Plant Demonstration</b></p> <p>Total Budget: \$6.0 million</p>	<p>Wind power generation market. Renewable energy market. Utility-scale.</p>	<p>Wind power installers and operators.</p>	<ul style="list-style-type: none"> <li>• Higher cost of wind power. (Wind energy will likely cost more than the market rate for wholesale electricity.)</li> <li>• New York State market for premium-priced green power is not yet developed.</li> <li>• Lack of infrastructure in an immature industry.</li> <li>• Intermittent nature of wind could make it difficult to sell under NY ISO rules.</li> <li>• Transmission constraints from wind sites to markets.</li> </ul>	<p>Help companies find, measure, and develop specific locations for constructing wind energy farms. Provide funding to stimulate development of renewable generation to wholesale markets. Build markets for premium-priced green power. Partially absorb risk associated with developing the New York green power market.</p>
<p><b>Wind Prospecting Program</b></p> <p>Total Budget: \$300,000</p>	<p>Wind power generation market. Renewable energy market. Utility-scale.</p>	<p>Wind power installers and operators. Site developers and siting officials (government).</p>	<ul style="list-style-type: none"> <li>• Expensive to find and characterize suitable wind sites.</li> <li>• High perceived risk by investors and developers of wind technologies.</li> </ul>	

**TABLE 3-6: New York Energy Smart<sup>SM</sup> Research and Development Continued)**

New York Energy Smart <sup>SM</sup> Program	Market Sector of Influence	Targeted Market Actors	Market Barriers Addressed	Intervention Strategy Employed
<b>Residential Photovoltaics</b>  <u>Total Budget:</u> \$1.25 million	Residential home market (new construction, retrofit, and remodeling). Renewable energy market.	Renewable energy marketing firms, PV installers, home and building owners, A/E firms, PV systems manufacturers and integrators.	<ul style="list-style-type: none"> <li>High installation cost and long payback of technology.</li> <li>Immature supply and service infrastructure.</li> <li>Difficulty in obtaining suitable financing for PV systems.</li> <li>Customer lack of information and awareness about PV technologies, its costs, benefits and limitations, what it can do for the customer, what their local solar resource is, and how to select and evaluate bids to install their system.</li> <li>Difficulties with interconnecting to the grid;</li> <li>Appraisers are unfamiliar with PV technologies for appraisal.</li> </ul>	Supports technology development to provide lower-cost and better products; End-user buy down programs (implemented through development of supply, installation and service business infrastructure); Loan/lease programs for installations; Training programs; Support of existing solar systems; Interconnection assistance; Business financing. The program also offers support for code officials.
<b>Photovoltaics on Buildings</b>  <u>Total Budget:</u> \$2.3 million	Commercial building market (new construction, retrofit, and remodeling). Renewable energy market.	Renewable energy marketing firms; PV installers, system manufacturers and integrators. Transmission, distribution, and service companies (ESCOs).	<ul style="list-style-type: none"> <li>Underdeveloped supply and service infrastructure.</li> <li>Customer lack of information and awareness.</li> <li>Interconnection difficulties.</li> <li>Transmission constraints.</li> <li>Other energy sources are less costly.</li> </ul>	Financial incentives offered for the installation of customer and cooperative owned wind systems and remote PV systems in New York State.
<b>High Value Photovoltaics and Wind</b>  <u>Total Budget:</u> \$1.3 million	PV and Wind renewable energy generation markets; farms, commercial businesses.	Agriculturalists, willow plantation owners, bio-fuel specialists.	<ul style="list-style-type: none"> <li>Lack of a defined bio-mass infrastructure/market.</li> <li>Lack of knowledge and expertise in biomass fuel production and use - including its benefits and costs to the environment.</li> </ul>	Establishment of a private cooperative to manage willow plantations that will provide wood as a fuel to power generating facilities. Determine and evaluate the costs associated with willow plantations as a biomass fuel supply, and the costs and benefits of co-firing willow or waste wood blends.

## REASONABLE EXPECTATION OF MARKET TRANSFORMATION PROGRAMS

Transforming markets for energy equipment, products, and services to a higher sustainable level of efficiency requires market-based intervention strategies that target and work with key market actors, including consumers, manufacturers, distributors, retailers, and energy service companies. While the concept of transforming markets is not new, the use of market transformation strategies to change energy efficiency markets is relatively untested. Progress in many regions of the country to date has shown that, developing a market infrastructure and network of market actors to uniformly adopt behaviors and take actions that support energy efficiency is a complex and often difficult task. Market progress is just now being reported for earlier market transformation programs in New England, Wisconsin, the Pacific Northwest, and California.

While there appear to be many early examples of limited success, it is recognized that widespread transformation can take many years. A recent report from ACEEE<sup>33</sup> states that: “while the markets for energy-efficient products are markedly improving in some areas (as evidenced by increased availability of energy-efficient products or services, improved stocking, broader awareness, and greater market share), other markets have been slow to adopt particular technologies or approaches. Those efforts that appear to be on the way to transformation are those that offer substantial non-energy benefits (*i.e.*, clothes washers, exit signs) or increased efficiency at little or no cost to the consumer (*i.e.*, home electronics). In general, the market transformation efforts for these products tend to be focused on relatively few market actors either because the distribution channels are limited (as with clothes washers) or because the emphasis of the effort is further upstream where there are fewer and often more influential stakeholders (as in the case of consumer electronics).”

A good example of a successful market transformation program is the Consortium for Energy Efficiency (CEE) National Clothes Washer Initiative. The market share for high efficiency clothes washers has increased in many geographic areas with heavy promotion (recording a one-year increase from 1998 to 1999 from 6.6% to 15.7 % in New England, 12.1% to 14.3% in the Northwest, 7.9% to 11% in California, and 6.1% to 10.3% in Wisconsin. (U.S. DOE 2000: 1999 figures are preliminary).<sup>34</sup> On the other hand, experience reveals that products or services with high incremental costs and few non-energy benefits have difficulty attracting more than a limited market. For example, ACEEE found that residential lighting products cost about 10 times more than standard lamps and, although they last much longer, their high initial cost appears to be a major factor limiting their market expansion. Similarly, ACEEE found

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<sup>33</sup> American Council for an Energy Efficient Economy. *Market Transformation Initiatives: Making Process*. May 1999, page 58.

<sup>34</sup> Van Wie McGrory, Laura, Maureen McNamara, Margaret Suozzo. *Residential Market Transformation: National and Regional Indicators*. Paper at ACEEE Summer Study on Energy Efficiency in Buildings, August 2000.

that high-efficiency residential central air conditioning systems carry a substantial first cost burden, which has limited the market share for this equipment to 15 to 20 percent.

Listed below is a short summary of reasonable expectations for market transformation programs based on the success of program interventions in other areas of the country.

Wisconsin. The State of Wisconsin Department of Administration (DOA) is responsible for deployment and evaluation of market preparation programs in Wisconsin. According to the May 2000 Interim Evaluation for the Wisconsin Focus on Energy program, a recurring theme in the early process interviews conducted with Wisconsin program administrators is that the eighteen month time-line for the Focus on Energy program (ends on June 30, 2000) is not long enough to effectively develop and test new approaches to the transformation of energy efficiency markets, and to see immediate market transformation results. This appears to be an issue of which DOA is already well aware, and one that is largely beyond DOA's control. Nonetheless, the challenges that have been encountered in developing and fielding programs within the Focus on Energy program pilot period appear to have important implications for the pace at which state-wide programs for the new public benefits mechanism are developed and implemented. The evaluation team in Wisconsin believes that developing successful new energy efficiency programs, not just market transformation programs, but any programs, generally takes at least several years, and a significant amount of trial and error.<sup>35</sup>

Northeast. In New England, the Northeast Energy Efficiency Partnerships (NEEP) organization has been designing and implementing market transformation programs since 1997. Information obtained by GDS Associates, Inc., from NEEP in June 2000 confirms that market transformation takes many years to take hold. Early market progress data from NEEP programs shows that market penetration for such consumer products as high efficiency clothes washers and residential appliances is increasing in response to NEEP's initiatives, but like the changeover from black and white TV's to color TV's in the 1960's and 1970's, change takes time.<sup>36</sup>

In Massachusetts, a recent paper presented by Boston Gas Company at the ACEEE 2000 Summer Study presents results of tracking over 270 indicators of market transformation between baseline measurements conducted in 1998 and follow-up measurements conducted in 1999. Boston Gas found improvement in only about half of these 270 indicators of market transformation after one year, with the remainder showing no improvement at all.<sup>37</sup>

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<sup>35</sup> Wisconsin Focus on Energy. *First Interim Report – Final*. May 2000. Pages 19-20.

<sup>36</sup> Telephone conversation with NEEP Program Manager, June 23, 2000.

<sup>37</sup> Spellman, Richard F., Bruce Johnson, Lori Megdal, Shel Feldman. *Measuring Market Transformation Progress & the Binomial Test: Recent Experience at Boston Gas Company*. Paper presented at ACEEE Summer Study on Energy Efficiency in Buildings, August 2000.

Northwest. In one of the closing sessions, at the recent ACEEE Market Transformation Symposium in March 2000, panelists from around the country reported on their market transformation initiatives and early results. A review of the market progress data presented by the Northwest Energy Efficiency Alliance (representing the states of Washington, Oregon, Idaho and Montana) at this symposium showed positive short term results with market transformation indicators relating to consumer awareness and market penetration. However, it is important to note that increases in such indicators are modest after several years of funding in the Northwest. Again, the message is that one should expect only very modest improvements in indicators of market transformation in the short term. For example, surveys conducted in New York show modest increases in consumer awareness of the ENERGY STAR® logo from 34% in 1998 to 35.4% in 1999.

### New York State's Assessment

Based on the experiences gained from other market transformation programs around the country, it appears that a strategically designed and effectively implemented three-year effort like the **New York Energy Smart<sup>SM</sup>** program, can be expected to yield some of the following results:

- Reliable market characterization and baseline information.
- Significant energy efficiency program implementation activities with market preparation focus.
- Limited end-user project completions and related energy and non-energy benefits.
- Some qualitative and initial quantitative indications of progress from market preparation to market transformation.
- Useful feedback on validity of program-specific logic and continued appropriateness of key program goals and objectives.
- Successful implementation of redesigned programs where needed.
- Broader acceptance and improved understanding/support for market transformation goals and program theory.

As shown in Sections 4 and 5 of this report, the **New York Energy Smart<sup>SM</sup>** program has demonstrated some early progress in each of these areas. In addition to measuring progress against these indicators, the **New York Energy Smart<sup>SM</sup>** market transformation programs are being evaluated based on their ability to create: (1) permanent changes in the decision processes for customer awareness, purchase, and use of energy efficiency products and services; (2) dealer and distributor decisions for stocking products and promoting energy efficiency; and (3) the development of markets with greater availability and choices for more energy-efficient equipment, products, and services. Planning and measuring progress for these three

goals requires a measurement of market barriers and market indicators. This has been accomplished by reviewing relevant market characterizations and by developing a process that relies on market baseline studies and indicator measurement as an integrated part of program development and implementation. Further information is provided on **New York Energy Smart<sup>SM</sup>** market transformation indicators in Section 4 of this report. In addition, Section 5 provides a brief discussion of how the portfolio of **New York Energy Smart<sup>SM</sup>** programs is transforming the market for energy-efficient products and services, one of NYSERDA's six public benefits goals.