Technical Assistance in Determining Options for

ENERGY EFFICIENCY in EXISTING BUILDINGS

CONSULTANT DRAFT REPORT

Prepared for:
CALIFORNIA ENERGY COMMISSION

Prepared by:
Architectural Energy Corporation

April 2005
CEC-400-2005-011-D

Prepared by:
Architectural Energy Corporation
Boulder, Colorado
Contract # 400-04-001

Prepared for:

CALIFORNIA
ENERGY
COMMISSION

Jackalyne Pfannenstiel
Vice Chair

Commissioners
Arthur H. Rosenfeld
James D. Boyd
John L. Geesman

Scott W. Matthews
Acting Executive Director

Valerie Hall,
Deputy Director
ENERGY EFFICIENCY and
DEMAND ANALYSIS DIVISION

Bill Pennington,
Office Manager
Buildings and Appliances Office

Dale Trenschel
Project Manager

Elaine Hussey
Contract Manager

DISCLAIMER

This report was prepared as the result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees or the State of California.

The Energy Commission, the State of California, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights.

This report has not been approved or disapproved by the California Energy Commission nor has the California Energy Commission passed upon the accuracy or adequacy of the information in this report.

Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings

Working Draft

April 18, 2005

Prepared for

California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Prepared by

Architectural Energy Corporation
2540 Frontier Avenue, Suite 201
Boulder, Colorado 80301

Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings

Table of Contents

Executive Summary ES-1

Information to All Homeowners ES-1
Residential Time-of-Sale Energy Ratings ES-2
Residential Equipment Tune-ups and O&M Services ES-2
Whole Building Diagnostic Testing ES-3
Low Income Multifamily Housing ES-3
Commercial Building Benchmarking ES-4
Retro-commissioning ES-5
Energy Efficient Commercial Leasing ES-5
Demand Response ES-6
Upstream Interventions/Manufacturer Partnerships ES-7
Energy Efficient Procurement and Procurement Support ES-8
Branding ES-8
Information, Case Studies and Demonstrations ES-9
Energy Efficiency Technical Training and Certification ES-10
Energy Efficiency Choice Risk Protection ES-10
Interagency / Cross Program Coordination ES-11

1. Introduction 1

2. Market Barriers 3

3. Actor Networks 11

Why Actor Networks? 11
What are Actor Networks? 12
Usefulness of Actor Network Thinking for Energy Efficiency Policy Development 15

4. Intervention Portfolio 19

Information to All Homeowners 19
Residential Time-Of-Sale Energy Ratings 27
Residential Equipment Tune-ups and O&M Services 40
Residential Whole Building Diagnostic Testing 49
Low Income Multifamily Housing 57

Benchmarking 63
Retro-commissioning and O&M 71
Energy Efficient Commercial Leasing 79
Demand Response 86
Upstream Interventions/Manufacturing Partnerships 98
Energy Efficient Procurement and Procurement Support Initiative 109
Energy Efficient Branding Initiative 123
Information, Case Studies and Demonstrations 135
Energy Efficient Technical Training and Certification Initiative 149
The Energy Efficiency Choice Risk Protection Initiative 164
Inter-Agency Cross-Program Coordination 171
5. Electricity, Natural Gas and Peak Savings Potential 190
Technical Potential 190
The Market Adoption Model 191
6. Cost Effectiveness and Market/Policy Readiness 200
Cost Effectiveness 200
Intervention Energy Savings Potential and Cost Effectiveness 202
Market/Policy Readiness 202
7. Policy and Legal Changes 213
Changes to Existing State Statutes 213
New Legislation 213
Energy Commission Policy 213
CPUC Policy 214
Policies of State Housing Agencies 214
U.S. Department of Housing and Urban Development 214
U.S. Green Building Council 215
Professional Organizations 215
8. References 217

List of Tables

Table 1. Utility Programs 180
Table 2. Statewide Programs 182
Table 3. Non-Utility Programs 184
Table 4. Intervention Energy Savings Potential and Cost Effectiveness 202
Table 5 Market and Policy Readiness Criteria Comparison.....211

List of Figures

Figure 1. Market Barrier Classification Framework 4
Figure 2. Market Actor Network Diagram for Information to All Homeowners 24
Figure 3. Residential Time-of-Sale Flow Chart 30
Figure 4. Residential Time-of-Sale Market Actor Network Diagram 36
Figure 5. Market Actor Network Diagram for Equipment Tune-up and O&M Services 45
Figure 6. Market Actor Network Diagram for Whole Building Diagnostic Testing 53
Figure 7. Market Actor Network Diagram for Commercial Benchmarking 68
Figure 8. Market Actor Network Diagram for Commissioning and O&M 76
Figure 9. Market Actor Network Diagram for Commercial Leasing 83
Figure 10. Market Actor Network Diagram for Demand Response 94
Figure 11. Market Actor Network Diagram for Purchasing Initiative 115
Figure 12. Market Actor Network Diagram for Branding Initiative 131
Figure 13. Market Actor Network Diagram for Demonstrations and Case Studies 145
Figure 14. Market Actor Network Diagram for Technical Training Grants 158
Figure 15. Market Actor Network Diagram for Energy Efficiency Choice Risk Protection Initiative 168
Figure 16. Market Actor Network Diagram for Interagency Coordination 176
Figure 17. Energy Savings Potential Process 190
Figure 18. The Technology Diffusion Model 192
Figure 19. Program Influenced Routes Through the Adoption Process 195
Figure 20. Non-Program and Program-Related Routes into the Adoption Path 196
Figure 21. The Normal and Program Related Routes into the Adoption Path 197
Figure 22. Barriers and the Routes into the Adoption Path 199
Figure 23. Avoided Costs Example from E Three Study 201

EXECUTIVE SUMMARY

California's existing building stock is vast and extremely diverse, with building types ranging from single family homes to high-rise multi-family buildings and from small businesses in strip malls to skyscrapers and cavernous warehouses. More than half of existing buildings were built before the first energy efficiency standards were in place. Despite over two decades of energy efficiency programs, a large reserve of potential energy and peak demand savings remains to be captured.

Assembly Bill 549 (Statutes of 2001, Chapter 905, Longville) directs the California Energy Commission (Energy Commission) to "investigate options and develop a plan to decrease wasteful peak load energy consumption in existing residential and nonresidential buildings" and report its findings to the legislature. The Energy Commission's initial response to this legislation was the report, Assessing the Energy Savings Potential in California's Existing Buildings: An Interim Report to the Legislature in Response to AB 549 (December, 2003 Energy Commission Report #400-03-023F) which was sent to the legislature in late December, 2003. The work performed under this project was based in part upon the initial work completed for that report.

A project advisory committee consisting of members from the Energy Commission, Pacific Gas and Electric Company, Southern California Edison, Sempra Utilities, and the California Public Utilities Commission was formed to oversee the project. This report provides a series of recommendations on steps that can be taken to improve the efficiency of existing residential and commercial buildings. The list of interventions is described as follows:

Information to All Homeowners

This intervention focuses on providing energy efficient technology choice information to all residential households through information, energy audits and referrals to existing energy efficiency programs. This intervention is not targeted at any particular trigger event, as strategies may be employed at any time to manage the population of residential buildings as a "fleet" of buildings with the goal of constantly improving the efficiency of the existing building stock. Elements of this intervention include:

- Target buildings with the greatest potential for energy savings
- Provide feedback on customer energy use through the a customer service link on the utility website
- Provide online home energy audit information in a multi-level format that allows the customer to more deeply explore their energy use patterns and options for saving energy. Additional levels of energy audits (e.g., over-the-phone, in-person) would be provided to targeted and/or interested customers.

- Connect customers with opportunities for financing energy efficiency upgrades either through existing programs or through a separate initiative.
- Provide customers with energy efficiency program marketing materials through bill stuffers, on-line customer service applications and Flex-Your-Power media campaigns.

Residential Time-of-Sale Energy Ratings

This intervention makes use of pre-sale energy rating process to provide additional energy-efficiency related information for consideration when homes are sold. A non-intrusive physical inspection of the energy features of the home is conducted, listing features such as attic insulation levels, window type, wall insulation levels, and the type and age of the heating and air conditioning system, water heating system and major appliances. Home inspectors hired by the seller prior to listing the home are likely to provide this information. The home inspection is also used to screen homes for a more comprehensive inspection. The observed energy features are used to calculate a home energy rating that indicates the relative energy efficiency of the home and identifies cost-effective energy upgrades to the home in sufficient detail to allow a prospective homebuyer to apply for an energy-improvement mortgage (EIM). The energy features and energy rating of the home become part of the information disclosed during the sales process. Specific recommendations relative to this intervention include:

- Changes to statutes governing home inspections to require an energy component to the current home inspection process
- Conclusion of the Energy Commission proceeding on Home Energy Rating Systems
- Establishment of a minimum portfolio standard for Energy Improvement Mortgages in the secondary mortgage market
- Incentives to buy down the cost of home inspections and HERS ratings
- Incentives to increase adoption of EIMs, including interest rate breaks, lender incentives, and realtor training on the EIM process

Residential Equipment Tune-ups and O&M Services

This intervention involves steps to improve the frequency and effectiveness of Heating Ventilation and Air Conditioning (HVAC) system tune-ups and maintenance services for single family and multifamily residential customers. This initiative is primarily directed at HVAC service technicians and would address HVAC system efficiency improvements resulting from testing and correcting airflow requirements, refrigerant charge, and duct leakage. By increasing the training and certification level of contractors, educating consumers about issues and solutions, and providing long-term program support through incentives and training, this initiative aims at transforming the residential tune-up and O&M market. Specific recommendations relative to this intervention include:

- Requiring HVAC system tune-ups using certified contractors at the time-of-sale of a residence and during equipment replacement
- Support for technician training through community colleges and vocational education schools
- Support for technician certification through the North American Technician Excellence, Inc. (NATE) program
- Marketing and brand support for enhanced HVAC maintenance and service offerings

Whole Building Diagnostic Testing

This intervention involves the implementation of a "house as a system" approach to the evaluation and remediation of design and installation defects in homes. Climate, building materials (and the way they are assembled), occupant interaction, and mechanical equipment design and installation all affect the house "system" performance. This intervention strategy allows the practitioner to identify flaws in building construction or operation, and also to use diagnostic tools to direct repairs for correcting the flaws. A detailed diagnostic evaluation approach allows the practitioner to understand building performance issues and implement strategies that improve occupant comfort, safety, and building energy efficiency. The approach uses a trained contractor to perform the diagnostic testing, implement the upgrades and verify performance in a streamlined one-stop process. Specific recommendations relative to this intervention include:

- Allow energy efficiency programs to value non-energy benefits in cost effectiveness calculations
- Permit qualified programs to self-verify performance based on documented testing protocols
- Engage the insurance industry to explore risk reductions benefits of whole-building diagnostic testing services.

Low Income Multifamily Housing

This intervention covers a series of strategies intended to improve the energy efficiency and affordability of existing low income multifamily housing in California. The interventions attempt to work within existing policies, procedures and agencies to the maximum extent possible. The following elements are envisioned for a coordinated strategy to improve the energy efficiency of multifamily and low-income housing:

- Benchmarking. Introduce benchmarking to the property managers and train them on how to use the system.
- Require energy ratings and energy efficiency upgrades for properties that participate in subsidized housing tax credit programs.

- Place greater emphasis on housing rehabilitation projects as important opportunities for improving energy efficiency.
- Target preservation projects, where the rehabilitation project preserves the housing as affordable.
- Use state agencies as a hub for providing efficiency information, training and funding.
- Revise utility allowances to account for energy efficiency.

Commercial Building Benchmarking

This intervention involves the use of commercial building energy consumption benchmarking as a means to gain the attention of decision makers that can influence the energy efficiency of a building and motivate these decision makers to implement improvements in energy efficiency. The overall elements of the benchmarking intervention are as follows:

- Require benchmarking during building financing and refinancing events. Financing/refinancing occurs periodically throughout the life of a building, starting at time-of-sale and is a time when it is appropriate to consider the operating costs of the building and ways to reduce those operating costs.
- Require benchmarking by utilities in customer utility bills. This element requires utilities to benchmark all commercial buildings. A mechanism should be provided for continuous updating of benchmarking scores with each billing cycle to track the effectiveness/impact of changes in building operations or installation of energy efficiency features. This service should be provided as a component of on-line customer service.
- Referrals to retro-commissioning programs and to retrofit programs. Benchmarking alone does not lead directly to energy savings. To motivate further investigation into what may be cost effective for the individual building, referrals to retro-commissioning and energy audit services should me made. Benchmarking is viewed as the first step in a process of further investigation and action.
- Target high consumption buildings. Benchmarking provides a means for utilities to target poorly performing buildings for retro-commissioning projects and/or energy audits.
- Energy Efficiency Marketing Information. In conjunction with benchmarking, the user of the benchmarking tool should be provided with effective marketing information to encourage further investigation and action to achieve greater energy efficiency in the building.

Retro-commissioning

This initiative focuses on services that can be offered in the market that correct faults in building systems operations and helps keep systems operating at their peak efficiency. The objective of this initiative is to place retro-commissioning services as well as tune-up and operations and maintenance (O&M) services into the market at key trigger points on an ongoing basis to maintain building system performance and reduce energy consumption. Elements of a retro-commissioning intervention should include:

- Develop case studies relevant to commercial building business environment. Case studies about commissioning in a commercial building context should be developed that are relevant to commercial building decision makers.
- Build infrastructure to provide commissioning services. Develop the skills and expertise of commissioning service providers.
- Create demand through incentives and/or tax credits. Provide financial incentives in the form of rebates or tax credits to stimulate interest in the market.
- Investigate risk issues and highlight case studies in the context of risk management. Commissioning buildings helps control risk from volatile energy costs as well as loss of tenants due to comfort issues and risks of litigation stemming from indoor air quality problems.
- Screen customers for retro-commissioning potential. Use the benchmarking system as an intake point and collect information needed to screen customers for retro-commissioning potential.

Energy Efficient Commercial Leasing

This initiative focuses on pushing the market to incorporate energy efficiency improvement clauses into commercial leasing contracts as one of the primary contractual leasing approaches. The split incentives that exist in commercial lease agreements where the tenants are responsible for the energy costs are a barrier to efficiency program participation. This effort would include the development of a standard set of energy efficient leasing agreements that could apply to a wide range of business types, and promotional efforts to place these agreements into the market in a way that moves the market toward these lease structures as an accepted and standard procedure. The elements of this intervention are as follows;

- Use existing model leases, such as the Building Owners & Managers Association (BOMA) model lease as a model for best leasing practices. The BOMA model lease has suggestions for clauses that encourage building owners to upgrade the energy efficiency of their properties. Movement from a net lease, where tenants pay all utility costs to a fixed base lease, where energy costs and benefits from efficiency upgrades are shared between tenants and building owners can accomplish this objective.

- Place content on the advantages of energy efficient buildings and the existence of model lease clauses into continuing educating classes required by the applicable state licensing boards for real estate agents, lawyers, property managers and appraisers. Make the energy efficiency modules one of the mandatory classes.
- Market the advantages of energy efficiency buildings and lease arrangements that encourage investments in efficiency to real estate agents, who are in a position to influence the tenant on property selection and lease terms.
- Use partner networks, such as Energy Star and Leadership in Energy and Environmental Design (LEED) to educate building owners about model lease provisions that encourage investments in energy efficiency.
- Include a provision into the lease that the building owner or manager should have the building benchmarked at least twice per year, and report the benchmarking data to the tenants. By engaging the building benchmarking intervention, the building owner will be exposed to a broad range of services through the benchmarking "portal," where information on retro-commissioning services and building audits will be available.

Demand Response

The deregulation of the electricity market has been accompanied by numerous problems including generation shortages, transmission congestion, and wholesale price volatility. Following the 2001 energy crisis, demand response in California has become an increasingly important policy and program initiative. Demand response programs may be grouped into two broad categories, reliability-based and marketed-based programs. Reliability-based programs are triggered during emergency conditions when the stability of the electrical system is in threat. Market-based programs are triggered by wholesale electric prices and offer incentives during general market conditions (also called price response programs). Elements of the demand response initiative include:

- Change rate structure in California to follow a time-of-use structure for low to medium energy use customers and a dynamic real-time pricing structure for large customers.
- Promote technologies that are enabled to read pricing signals and make their use commonplace. Reduce costs associated with metering technologies.
- Offer programs, such as enhanced automation that help companies maximize benefits from real-time pricing and build in automation to buildings where possible.
- Develop informational programs to educate consumers about real-time pricing and how it can help save more money.
- Continue research for technologies through the Energy Commission's Public Interest Energy Research (PIER) program and other programs.

- Building and appliance standards should also address demand response programs aside from energy efficiency. That is, if automated load shedding features are slowly implemented into appliances, then demand response pricing signals will be fully used.
- There should be a phase in period for rate tariff changes. That is, there could be a six month to one year transition period where customers would be provided with a “shadow bill” that shows them what they would be paying in the dynamic pricing rate structure and what they are currently paying.
- Educate customers on peak and off-peak prices, what electricity costs at various points in time, and the types of appliances or equipment that consume on-peak power.

Upstream Interventions/Manufacturer Partnerships

This initiative uses upstream interventions that focus on the manufacturer. Elements of the initiative include R&D to develop new products and incentives provided to the manufacturer to reduce the cost of manufacturer goods sold. Information dissemination is another key element of the initiative and would include documentation and distributing case study and demonstration material. The initiative would be driven by manufacturer efforts to market the energy efficient technology. Procurement and purchase incentives are another upstream intervention, discussed separately, that will reduce unit manufacturing and marketing cost through economies of scale.

All of these interventions are designed to reduce the risk and cost of producing and deploying new energy efficient products. Due to mark-ups occurring throughout the distribution chain, incentives or initiatives applied at the manufacturer level may be more cost effective than those applied at the consumer level. These upstream activities stimulate the development of new energy efficient products at an accelerated pace, with a higher efficiency level and lower manufacturing cost than would otherwise be achieved. Overall recommendations for this initiative include:

- Prioritize Technology Development Opportunities - Look at energy use and demand in California and ongoing efforts to reduce consumption and peak demand. Identify needed products and their desired characteristics. Set product development goals including desired timing based on this assessment.
- Develop Manufacturer R&D Partnerships - Identify key manufacturers and their possible roles in participating in this initiative. Focus one-on-one efforts with potential key partners and move forward to cement relationships and initiate these partnerships.
- Upstream Incentives - Examine existing and past incentive programs and determine which end uses and product types are most amenable to upstream interventions that include rebates and other financial rewards.
- Market Connections - Mobilize market connection efforts that follow the recommendations of the Information, Case Studies and Demonstrations Initiative.

Energy Efficient Procurement and Procurement Support

This initiative focuses on state and local government purchasing procedures and the acquisition standards associated with energy efficient product specifications. While energy efficient equipment procurement is not new to California, it is not aggressively pursued on a statewide basis, nor are there strong promotional efforts that keep attention focused on energy efficiency. Likewise, there is a lack of expertise within the California purchasing community that allows for constant concentration on acquiring the most cost-effective products. The procurement initiative contains the following elements:

- The program should be voluntary. The Energy Commission should not propose an initiative with mandatory participation, it is not needed and the resistance to a mandatory approach would be strong.
- The initiative should have a strong central product assessment office that evaluates the energy efficiency of products that are purchased within the public and non-profit markets.
- The staff conducting assessments should be skilled scientific investigators who understand the physics and chemistry associated with the products and their ability to influence energy consumption. Assessment should allow contract awards to be defensible during the bid process.
- The initiative should have a strong sales force. Without a strong sales force that can bring the product testing results to the thousands of state and local government organizations that could use the information, the success of the initiative would be questionable.
- The initiative should have a statewide communications effort. The initiative would need to maintain communications relative to the changing products and analysis conducted, verified, and disseminated. The program should be established to provide feedback to participating organizations so that they know how much energy they are saving by using the coordinated energy efficient purchasing approach. The initiative should proclaim its successes within the purchasing community and the public.
- Make it easy to participate. The initiative will need to employ tactics that are compatible with user needs and timelines, and be user friendly.
- Coordinate, design, and launch with the already established EPPT (Environmentally Preferable Purchasing Team) that now has 30 departments within the team structure.
- Place the implementation branch of the initiative within the procurement offices of the state rather than within the energy offices of the state.

Branding

This initiative focuses on the use of energy efficient technology or technology-service branding and its potential to capture additional energy savings in the

residential and nonresidential sectors. Although there is considerable interest in the use of branding and co-branding to capture additional market share for energy efficiency programs, there is also considerable entrenchment in the management practices of the current brands such that they may not reflect the most efficient product choices or cover all of the technologies and services needed in California. Elements of this initiative include:

- Continue to reference Energy Star, but incorporate higher tiers to promote more efficient products
- Limit incentives to higher tier products
- Establish co-brand, and use co-brand to promote product lines not covered by Energy Star
- Work with other states and organizations such as Wisconsin, New York, Vermont and the Consortium for Energy Efficiency to coordinate efforts to push efficiency levels and incorporate new products into the marketplace
- Use Energy Star as a minimum level for purchasing programs.

Information, Case Studies and Demonstrations

This initiative provides technology transfer materials needed to make the market connections to effectively overcome information-related market barriers that would otherwise inhibit the market penetration and use of energy efficient products and services. This initiative supports all the other initiatives in the program. Elements of the initiative include: identifying key market participants; determining related market barriers; designing and developing information products to overcome those barriers; and developing and executing a plan to get the information products to the relevant stakeholder. Specific elements include:

- Identify information dissemination opportunities. - Look at all other initiatives in this program to identify market barriers and product information opportunities to overcome these barriers.
- Design information products – Develop information products to overcome market barriers that includes fact sheets, brochures, guidelines, training materials and training sessions, presentations, papers, and walk-through tours. This would include design and execution of demonstrations to provide documented, credible case study information.
- Develop Information Dissemination Plan - Prepare and carry out a plan for distributing information products to overcome market barriers that includes fact sheets, brochures, guidelines, training materials and training sessions, presentations, papers, and walk-through tours. Use utilities and their energy centers, government organizations and their clearinghouses, manufacturers and their distribution chains, industry trade associations and their channels to reach building owners, specifiers, facility managers, users, and energy efficiency and environmental advocacy groups, to provide information to their constituents.

Energy Efficiency Technical Training and Certification

This initiative focuses on an expanded training and certification effort to develop energy efficiency awareness and technical skills for a variety of residential and commercial market participants. It is anticipated that training experts would help influence the quality of services offered and certification would strengthen market confidence leading to expanded market demand. Market participants targeted include energy auditors, retro-commissioning service providers, whole-building contractors, property managers, building operators, and real estate professionals. Elements of this initiative include:

- Develop a central education, training and certification office to coordinate efforts. An organization like the Energy Commission or an independent private sector or non-profit organization skilled in these approaches would need to champion the effort.
- Engage community colleges, vocational schools, utility education centers, union training programs and professional training institutes to improve the likelihood of success.
- Work with existing trade associations, regulatory agencies and certification programs to insert energy efficiency content into training materials.
- Coordinate this initiative with other efforts that build demand for efficiency programs to avoid mismatches in the number of trained professionals and the demand for services.

Energy Efficiency Choice Risk Protection

This initiative focuses on addressing key market barriers that when combined, make up one of the most important barrier combinations in the market. These barriers include risk avoidance, skepticism about benefits, reliability uncertainty and performance uncertainty. These barriers build on each other, reinforce themselves and limit market movement toward the energy-efficient choice. This combination of barriers is among of the most powerful influences in the market and significantly outweighs price considerations or payback periods, yet very few programs address these critical barriers independently and no programs address them collectively. Incentive programs, which are the most common and popular program type in California, primarily address the price barrier. The choice risk protection initiative consists of the following elements:

- The formation of a risk assessment function that examines the technology mix covered by the program offerings and determines the costs and benefits of reducing the financial risk associated with non-performance of energy efficient technologies.
- Identify a set of programs that can benefit from the risk reduction initiative. This assessment would examine the technologies covered in the program and the as-installed conditions in which those technologies would be placed.

- Develop a set of cost tables that would be used to drive program design decisions regarding how much of the risk cost should be carried by the initiative and how much should be carried by the participant.
- Develop a pilot program to add a risk mitigation component, in collaboration with manufacturers, distributors, and dealers of a product and other industry stakeholders who are already in the business of providing product performance guarantees and insurance.

Interagency / Cross Program Coordination

This intervention addresses the potential to establish a statewide initiative focusing on the issue of inter-agency or cross-organizational program coordination and referrals. Energy efficiency program delivery efforts are scattered through a host of organizations and agencies, including the Energy Commission, the Investor-Owned Utilities, municipal utilities and non-utility program implementers. Program effectiveness can also be improved through coordination between efficiency programs and other agencies with policies and procedures that affect the delivery of these programs. This initiative has several elements:

- Make coordination part of program implementation plan requirements. Program implementers should present plans on how their program delivery effort will be coordinated with other efforts as part of the program implementation plan. The coordination plan should also include efforts to coordinate program evaluation.
- Central referral system. Develop a central program referral system for customers and program implementers.
- Develop policy on how to share energy savings between programs offering and receiving referrals. There is no current policy for programs to coordinate and provide referrals. A mechanism to account for and value inter-program referrals should be developed.

1. INTRODUCTION

California's existing building stock is vast and extremely diverse, with building types ranging from single family homes to high-rise multi-family buildings and from small businesses in strip malls to skyscrapers and cavernous warehouses. More than half of existing buildings were built before the first energy efficiency standards were in place. Despite over two decades of energy efficiency programs, a large reserve of potential energy and peak demand savings remains to be captured.

Assembly Bill 549 (Statutes of 2001, Chapter 905, Longville) directs the California Energy Commission to "investigate options and develop a plan to decrease wasteful peak load energy consumption in existing residential and nonresidential buildings" and report its findings to the legislature. For the purposes of this project, options capable of reducing peak energy consumption include those that increase the efficiency of equipment that uses electricity during peak periods or that shift or shave peak demand. Options that reduce natural gas end-use consumption are included because they can help stabilize gas supplies and reduce price spikes in both electricity and gas markets since a large and growing portion of California's electricity generation is fueled by natural gas.

The Energy Commission's initial response to this legislation was the report, Assessing the Energy Savings Potential in California's Existing Buildings: An Interim Report to the Legislature in Response to AB 549 (December, 2003 Energy Commission Report #400-03-023F) which was sent to the legislature in late December, 2003. The work performed under this project was based in part upon the initial work completed for that report.

This project was lead by Architectural Energy Corporation (AEC) under Contract Agreement No.: 400-04-001. Subcontractors assisting in this effort are TecMarket Works, Lutzenhiser Associates, RLW Analytics, Morton Blatt and the Davis Energy Group.

To contribute guidance for this study, a Project Advisory Committee has been formed comprised of members of the California Measurement Advisory Council (CALMAC), which includes representatives from the investor owned utilities, the California Public Utilities Commission (CPUC) and the California Energy Commission (Energy Commission). The Project Advisory Committee has provided guidance to the contractor and was involved in the review and approval of deliverables during the course of the contract.

This report, with a separate volume containing appendices, describes a series of activities undertaken during the course of the project, including literature reviews, program manager interviews, key informant interviews, expert panel discussions and additional in-depth analysis of consumer opinion survey and appliance saturation survey data. Market barriers to adoption of efficient technologies are discussed, and a set of interventions aimed at reducing these barriers are suggested. The focus of these interventions is on initiatives that are outside the current reach of appliance or building energy efficiency standards. The main report sections are as follows:

Chapter 2. Market Barriers. A summary of the research on market barriers and a model for understanding how these barriers affect product choice decisions is presented.

Chapter 3. Actor Networks. A discussion on the use of Actor Networks to understand the complex interactions between interest groups operating within each intervention is provided.

Chapter 4. Intervention Portfolio. A set of interrelated, mutually supportive interventions is described in this section, with the goal of increasing the efficiency of existing residential and commercial buildings in California.

Chapter 5. Electricity, natural gas and peak demand savings potential.

Chapter 6. Cost effectiveness and policy readiness

Chapter 7. Policy and Legal Changes.

Report Appendices to be published under a separate cover are:

Appendix A. Existing Research Review. A review of efficiency program strategies and behavioral research relevant to the development of new initiatives. These results were developed early in this project.

Appendix B. Sample interview and panel discussion guides

Appendix C. Primary Market Research. Based on the results of earlier work, additional primary research was conducted to answer key questions. The market research conducted included a series of key informant interviews and expert panel discussions.

Appendix D. Behavioral Science Research. Additional research was conducted to address specific questions raised early in the project work regarding consumer opinions and market segmentation that may affect initiative design and targeting.

Appendix E. Detailed Segmentation Tables. Data tables extracted from the Residential Appliance Saturation Survey (RASS) used in segmentation analysis.

Appendix F. Energy Analysis Assumptions. Details on the energy impacts and cost effectiveness calculation assumptions.

2. MARKET BARRIERS

Within the product diffusion and adoption literature rests the concept of reducing the barriers that limit product adoption so that products can be more quickly or more easily acquired and used by customers. This concept is simple in its foundation. If there are barriers that keep a customer from acquiring a product, by reducing or eliminating those barriers the customer will more quickly purchase and use the product. This concept is as old as the first transactions between humans in which one person convinces another to buy and use a given product. Essentially, the ability to overcome market barriers is the premise on which most energy efficiency programs are founded. But more than that, it is the foundation on which all product marketing is based. Reducing the barriers associated with having customers acquire and use the more energy efficient product or practice allows policy makers to consider energy efficiency and conservation as an energy supply resource. If market barriers can be eliminated or reduced, then substantial portions of California's increasing energy demands can be met through energy efficiency. If not, then new energy supplies, new power plants and new distribution systems will be needed to meet growing demand, and energy-related costs and the effects of increased hydrocarbon use will characterize this trend. Because of these conditions, understanding and reducing market barriers to efficient energy use is a critical part of any program initiative.

This section of the report examines the types of market barriers that restrict energy-efficient product adoption and discusses how these barriers stand in the way of a more energy efficient future. By understanding barriers, program designers are able to design and implement programs that remove the barrier's ability to stand in the way of achieving greater energy savings, or acquiring additional energy resources. Likewise, when policy makers better understand market barriers and how they inhibit an energy efficient future, they are more able to craft policies that help ensure that future energy needs will be met cost effectively and with fewer environmental and economic impacts.

This chapter classifies energy efficiency, energy procurement and demand reduction/response program market barriers into five classifications. Specific barriers placed within these classifications can reside in more than one classification. However, to avoid double-counting, individual barriers have been placed within a single classification that best describes the barrier. For example, the product cost barrier can be considered a product or a participant barrier. Looking at product cost as a function of the product, the barrier is best classified as a product barrier. However, looking at cost as an ability to pay barrier (such as in low-income programs) then it is best classified as a participant barrier. Where the barrier is placed in the framework is less important than recognizing it as a key market barrier.

Figure 1 provides an overview of the barrier classification system employed. It consists of five types of barriers. These are:

1. Product Barriers

2. Participant Barriers
3. Market Barriers
4. Purchase Barriers, and
5. Provider Barriers

Following Figure 1 is a brief explanation of each barrier type with an example of the specific barriers that are classified under that type. In providing the barrier examples the most important barriers within each category have been listed that need to be addressed within the program design and development process.

.

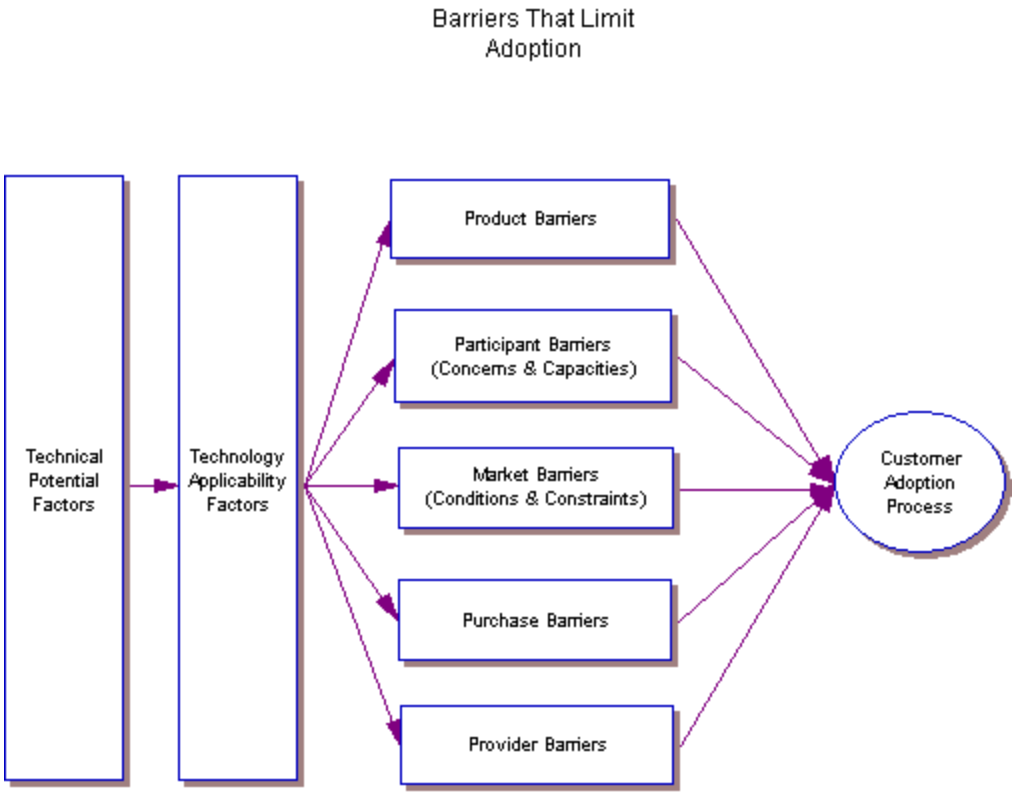


Figure 1. Market Barrier Classification Framework

Technical Potential Factors. These factors describe the potential for a particular technology to save energy and peak demand in an individual application. These are generally described in terms of unit energy consumption on a technology or end-use

basis and the expected energy savings fraction resulting from deployment of the energy efficient technology.

Technology Applicability Factors. These factors describe the potential for a particular technology to save energy and demand throughout a particular market sector or building type. Issues such as equipment saturation by building type, the appropriateness of a particular technology in a particular application and the penetration of efficient technologies into the market are considered.

Product Barriers. Product barriers are defined as technical attributes, costs, and other characteristics of products and technologies that limit customer acceptance and adoption. From the adopter's perspective the product must be the right product for them, it must meet their needs and fill the function for which they need the product. If the product does not meet these needs, the customer will not purchase the product. A good example of this barrier is product configuration. In one audit a company needed a 25 horsepower blower motor. However, the configuration of the motor allowed installation only using hardware available in 125 horsepower models. As a result the 125 horsepower motor was placed in service. Unless the product meets the needs of the decision maker, alternative products and approaches will be used.

The key product barriers include:

1. First cost: the acquisition costs, typically the price of the product

2. Life-cycle cost: the cost to acquire, install, use, maintain and dispose of the product

3. Payback period: the time the product recovers its cost through benefits provided by the product's use

4. Hidden or unexpected costs: added costs that are associated with the product that are not known or revealed during the purchase considerations

5. Reliability uncertainty: how reliable the product is to use/operate, expected down time is a key component of this barrier

6. Performance uncertainty: the service provided by the product, how it delivers on the reasons for which it was obtained

7. Configuration or product design: the way the product meets needs or expectations pertaining to its design characteristics, including such items as size

8. Available options: does it come with the options needed or wanted. These can be hardware, software, or ancillary service options. These can be major options or minor options, such as color choice.

9. Unwanted characteristics: if there are any unwanted characteristics (not specified above) associated with the product

These are the key barriers associated with the product itself. It should be pointed out that these "barriers" could just as easily be beneficial attributes of the product. That is, if the product is satisfactory in all these characteristics they become beneficial attributes that help speed adoption instead of slowing adoption. Energy efficiency

programs, particularly resource acquisition programs, do not typically focus attention on product barriers. However, programs that are designed to transform the way in which markets work have focused on product barriers. Some examples include programs that work with compact fluorescent lamp (CFL) manufacturers to help make sure that the market has a selection of bulb sizes, types and pricing advantages, or Energy Star programs that work with manufacturers to get more energy efficient product designs into the market.

Participant Barriers. Participant barriers are defined as cognitive, cultural, organizational, financial, and related factors that are internal to the firm or household and that interfere with the decision to purchase an energy efficient product. These barriers pertain to the individuals and decisions makers within a targeted market or market segment. The top participant barriers cited include:

1. Lack of awareness of a problem: (or opportunity), that is they do not know that there is an issue or a problem or an opportunity that is available to, in some way, improve their life or the lives of others,

2. Skepticism about benefits: (including non energy benefits), not sure or do not believe that the benefits predicted are real or that they will be realized if they take the recommended action.

3. Lack of personnel or time: not enough resources in terms of time or staff or ability to research the issue in question. The market transformation literature identifies this barrier as the “hassle” or “transaction cost” barrier.

4. Lack of perception of seriousness of problem: when the customer does not believe that the problem is real, or that there is justification or cause to fix a problem that may not be real.

5. Inability to obtain financing: lack the ability to obtain the capital needed to take an action.

6. Lack of ownership of the problem: a belief that the problem belongs to someone else and therefore is not their responsibility or concern.

7. Lack of sense of efficacy in possible actions: lack of belief that they have the power or ability to make a change that provides benefits.

8. Institutionalized procedures: procedures or decision systems within the individual’s decision networks that block or that are presumed to block the ability to respond to the problem or to react to capture a benefit. Sometimes these are as simple as rules-of-thumb decision systems that do not allow for change to easily occur, or that past approaches have worked and customers see little need to change. As such, these procedures can be formal or informal. The market transformation literature labels this barrier as “bounded rationality.”

9. Future uncertainties: the customer is not sure about their future and is reluctant to make decisions that rest on their future position or condition.

10. Risk avoidance: Potential adopters of energy efficient technologies are often risk adverse for a host of reasons associated with several of the barriers identified in this chapter. However, there is also a barrier that is associated with making a wrong

decision, and then enduring the consequences of that decision for an extended period of time. This is the risk factor that is in itself a barrier. While the technology may be sound, and provide promised performance or economic benefits, the risk associated with making that decision, especially if it is different from past or institutional procedures or rules-of-thumb precepts, may be too great for the decision maker.

Energy efficiency programs have typically focused significant resources on these barriers. Information and educational programs focus on these barriers by informing and educating customers on benefits or in helping them make purchase decisions. Programs that offer financial assistance that would otherwise be unavailable address this barrier. Programs that are designed to help make point-of-sale purchase decisions, such as the Energy Star labeling programs, also address this barrier.

Market and Market Operations Barriers. There are also market structure barriers. Market and market operations barriers are defined as *external* resources, relationships, networks, and other factors in the environments which households and firms are situated. Some of the key market and market operations barriers cited include:

1. Lack of professional expertise: there is a lack of resources in the market that customers can go to for help or information. This typically is seen as a lack of knowledge or skills about products or product issues that can be accessed.

2. Equipment availability: not sure that the equipment is actually available in the market or is available for the conditions needed.

3. Service availability: the market lacks the ability to service the product, leaving the customer feeling that there is a risk in adopting the product because they will not be able to get it serviced or maintained.

4. Parts availability: not sure that parts for the equipment will be available under the conditions needed. This barrier is closely tied to the lack of professional expertise and service availability in the market.

5. Lack of usable and trusted information: the market does not have or provide the type of information needed, or when it does, the information is not trusted. The market transformation literature identifies this concept as “asymmetric information.”

6. Financing availability: the market does not offer the needed type of financing for the product. This is different from the participant barrier of not being able to obtain available financing. This is when the market does not offer financing or financing options that are needed by the customer.

7. Others receive benefits: the benefits of the product are provided to others so that the decision maker does not receive the expected benefits. This has been referred to as “split incentives” within the market transformation literature.

8. Market uncertainties: relative to the product or provider, this barrier is associated with the potential participant not being sure about the technology market or having concerns about the stability of the market and its ability to respond to their needs.

9. Lack of market value: the value of the energy efficient product or service in the market is lower than the cost, restricting placement in the market.

Energy efficiency programs have typically focused some level of resource on the first of these barriers through skill training for a limited set of program stakeholders, but for the most part have not addressed the other market barriers. Few programs focus on the ability to obtain fast, reliable service, nor have they focused on parts availability for the energy efficient products that were purchased because of incentives offered.

Purchase Barriers: Purchase barriers are defined as factors that interfere with the decision-making process about particular technologies and operational changes. The key barriers associated with purchase decisions include:

1. Decision threshold requirements: this barrier includes having program-covered technologies that fit within the decision thresholds (decision processes and requirements) of the customers making those decisions. For example, if an industry must have technology upgrades that recover added cost in 3 years or less, the success of a program may hinge on the technology's ability to meet this requirement.
2. Need to see it and make it real: (gain comfort with concept), this barrier is associated with the decision maker's need to be able to see the technology in operation before they can make an adoption-related decision. Many decision makers need visual confirmation of a technology and need to see it in actual operation, delivering on the expected benefits, before they will adopt the approach.
3. Need to have experience with it: this barrier is closely related to the need to make it real, but goes a step beyond. Many decision makers require actual hands-on experience with a technology before they consider a purchase decision. This is especially important in industrial sector initiatives and to a degree, the commercial sector. Within the industrial sector, a bad technology decision can have very significant implications and ruin careers. For decisions that have large dollar implications it is critical for some decision makers not only see the technology, but also to have experience with the operations of that technology.

Energy efficiency programs have not typically focused significant resources on these barriers other than to provide general information that customers can use to inform their decision process.

Product Provider Barriers: Energy efficiency program designers often ignore the product provider barrier category, yet for a good percentage of customers, it is a critical barrier group. Product provider barriers are defined as considerations related to the suppliers of particular technologies and technology-related services. The product provider barriers cited include:

1. Ease and speed of acquisition / availability: This deals with how fast the provider can deliver or service the technology. For many decisions, the speed of the service provider is a critical barrier. If the energy efficient product provider is not

capable of high-speed delivery and service, the customer may not adopt that technology, but stay with a technology for which service speed is not an issue.

2. Familiarity and expertise with product: This barrier deals with how familiar the provider is with the energy efficient technology. If the provider is not familiar with it, if it is something new to their product line, the adopter is more likely to stay way from the technology or that provider.
3. Hidden or unexpected provider costs: This barrier is associated with added costs from the service provider. If the energy efficient product provider adds costs to the product or service that the adopter does not consider appropriate, he/she is likely to not go with that technology from that provider.
4. Support for product: This barrier is similar to the service provider barrier associated with the market, but it applies to a specific provider. If the technology provider cannot service and support the product and the needs of the customer adopting the technology, then that provider will not be as capable of moving the product in the market.
5. Ability to service other needs: This barrier relates to the energy efficient service or product provider to meet a host of other needs that are required by the adopter. This is especially critical in commercial and industrial businesses where business relationships are seldom established over a single product. The provider of the energy efficient technology must fit in with the package of services needed by the customer.
6. Market professionalism and social acceptability: Lastly, customers expect a level of professional service from their technology providers. Business relationships are important, and decision makers establish technology purchase and service relationships with businesses that meet the standards of professionalism required by the buyer, or by social consideration in addition to other decisions. These can be driven by objective assessments of the provider and the provider's organization, or by other criteria such as social relationships or other criteria.

These five barrier classifications represent the major barriers that need to be addressed in the program design process. While not all of these barriers apply to a program, they all typically apply to at least one program within a portfolio of programs. In understanding these barriers it is important for the program designers to fully assess themselves and their programs in light of these barriers and not just think of these as barriers that apply to the market where their programs operate. The program designer needs to ask, "How does our program score on these critical market barriers and what can our program offer to overcome these barriers?"

As part of the AB 549 research effort, a set of program interventions, or initiatives, have been identified that can be designed and implemented to capture additional California energy savings. These interventions must address market barriers to be able to capture the market potential associated with each initiative. Market barriers specific to the initiatives are presented in Chapter 4 along with the individual initiatives recommended for development and implementation. If the barriers are addressed in a way that successfully reaches and motivates customers to

participate, the energy savings associated with those initiatives can be achieved. However, these achievements will not be easy. They will require expert program design, development, implementation and evaluation for a number of years to be successful at capturing the available potential. Nevertheless, California is in a good position to launch these initiatives and capture further energy savings.

3. ACTOR NETWORKS

In earlier AB 549 work, we reviewed the social and behavioral sciences literature related to energy efficiency. As a result of that review, we identified "actor network" dynamics as one of several potentially important areas for primary research for subsequent work. Actor networks can be defined as a system of interacting individuals that influence decisions affecting the efficiency of buildings. We concluded that:

"An actor network approach … [would allow] actors and interests in the existing buildings systems (residential and commercial) to be identified and better understood. … studies have shown that unlikely actors have been found to play key roles in innovation and long-term change in technological systems. We do not know, with any clarity … who the salient actors are in existing buildings markets, or what the dynamics of those markets look like." (Lutzenhiser Associates 2004)

A series of expert interviews and panel discussions were conducted to explore issues related to current and proposed energy efficiency policies and program approaches. During those interviews and panel sessions, several questions were asked regarding key individuals and their roles in both business-as-usual and in energy efficiency innovation. While time and resource constraints prevented us from gathering comprehensive and detailed data on actor motivations and behavior from a wide range of knowledgeable observers, useful insights were gained regarding key actor types.

This chapter offers an overview of the actor network approach and offers the rationale for applying actor network theory and models in energy efficiency policy development. It is intended mainly as an orientation, however, and not as a comprehensive guide to actor network analysis.

Why Actor Networks?

When considering human choice and action related to energy use and energy efficiency, models that assume simple rationality and even the influence of psychological attitudes have fared poorly in predicting behavior. Energy use and efficiency adoption are group rather than individual processes, and persons' choices—whether in households or organizations—are influenced and constrained by the choices of others, both past and present.

In the energy efficiency market transformation tradition, these dynamics have been handled by the notions of "market barriers" (e.g., Eto et al. 1996) and market conditions. They also fall within the domain of "technology transfer" (e.g., Blumstein et al. 2001). In the energy and behavior literature, they have often been framed as issues of "culture," social structure, lifestyle, and consumer behavior (e.g., Lutzenhiser 1992, 1993, Lutzenhiser et al. 2001, Wilhite and Lutzenhiser 1999).

The actor network tradition, on the other hand, is rooted in social science studies of technology and innovation—mostly by historians, sociologists and economists who

are interested in explaining change in complex socio-technical systems through time. It is a fairly new theoretical approach and line of inquiry, and while it is being applied in various spheres of technology decision-making, to date it has influenced energy studies only to a very limited extent (e.g., Shove 1997, Shove et al. 1998, Wilhite et al. 2001).

We do not propose that it should be a guiding model for the AB 549 project, nor that it should replace the more conventional frameworks/models focused on barriers and markets. Just how all of these different approaches inter-relate remains to be discovered. It is clear, however, that each offers a somewhat different view of the same phenomena—namely complex technology decision-making (in this case, energy efficiency decision-making) within multi-actor systems.

For the AB 549 research, actor network theory (ANT) has functioned largely as a heuristic—a set of insights and a sensitizing "model" (more of a sketch of a model) that keeps us mindful of the complexity and multi-actor character of the systems we are interested in changing. This heuristic led us to ask expert interviewees and panel members about the different individuals involved, their interests and their respective roles in decision-making related to the intervention possibilities under consideration. It led us to assemble the data we could on different actor types, and it allowed us to offer some insights about those individuals to complement analyses of market barriers and conditions.

What are Actor Networks?

In the technology studies literatures, the questions "how" and "why" certain technological changes take place while others do not (and why some innovations succeed when others fail) have led to a series of explanations, based on examination of particular technologies. Without reviewing those literatures here, it is useful to point to some key ideas that most share. These include the following:

- Technologies are embedded in social systems that shape them, and societies are, in turn, embedded in technical systems that constrain and channel their development (Pacey 1991, Hughes 1993). This is as true for hunter-gatherers as it is for modern Californians (White 1976, Wilk 1996).
- Choices related to the adoption of innovation are socially segmented, constrained, and influenced by social networks (from which potential adopters get information, observe other innovators, check out their social status, etc.) (Rogers 2003).
- Modern innovation takes place within the contexts of very large, complex, *socio-technical* systems that exhibit inertias as well as momentum, and sometimes unpredictable rates of change (Hughes 1989). The notions of "lock-in," "path dependency" and "technological trajectory" (e.g., Dosi 1982, Bijker 1997) all

capture aspects of inter-connection, dependency, and limits to control in such systems. [1]

- At the same time, recognition of the complexity and ambiguity surrounding genuinely new developments (e.g., the VCR, cell phone, distributed generation, nano-technology, ubiquitous remote sensing or "smart dust") points to the importance of meanings, interests, conflict, competition, and negotiation in the *social shaping* of technologies. This is the area where the "social construction of technology" (SCOT) theorists have done their most productive work, and where the talk about "actor networks" began to emerge about 15 years ago (see Bijker et al. 1989, Bijker and Law 1994).
- So, it may be the case that—in addition to the problems of lock-in and path dependency—complex networks offer possibilities for multiple stakeholders to be effective, for multiple development paths to exist, and for multiple technological solutions to be possible.
- Actor networks, in short, are systems in which inter-related and inter-dependent actors work to both stabilize and alter elements of those systems. Choices are contingent, and sometimes contingent upon other choices made more or less *invisibly*—at a distance in geographic space, in social space and/or in time. Outcomes are uncertain, but actively negotiated by different interests—who bring with them different concerns, motivations, stakes, perceptions, and degrees of risk or exposure.

Why are these arrangements called "actor" networks and not simply social networks or technology systems or markets? All of these are acceptable terms, since they all somewhat hit the mark. However, the "actor network" terminology is a bit more spare (loaded with less baggage) and is somewhat more precise.

First, these systems are not accurately characterized as being composed only of their technical elements—although this is often what is figuratively done in appliance saturation-based forecasting and technical potential studies. How *persons use* technologies results in vastly different energy flows through otherwise similar sets of devices and buildings. Second, these networks cannot be reduced simply to social networks, since they are not composed only of people. They are instances of what Hughes (1989) has labeled "socio-technical systems," and as such, they are made up of people, pre-existing technologies (often termed "artifacts" in ANT), and widely-held social agreements or "institutions" (conventional ways of proceeding, such as rules, that are human products, but are not human beings per se).

---

[1] "Lock-in" refers to processes in which past widespread choices (e.g., favoring compression-cycle refrigeration vs. ammonia absorption cycle) have led to the creation of a production and support infrastructure (e.g., refrigerant manufacture, motors development, HVAC services, etc.) that "locks" one technology in (and locks the other out). Path dependency and technological trajectories are similar concepts. For example, the pattern of compressor air conditioning plus light frame construction plus low cost electricity plus private cars and a public highway system creates "paths" that become unquestioned common practice upon which the construction industry "depends." The resulting "trajectories" of historical development led inevitably to sunbelt suburban development, with its attendant problems.

In the case of AB 549, the systems that we are interested in altering involve energy use and energy flows in dwellings and offices. Let us take the case of single-family detached dwellings. The system of interest is composed of the homeowner (or landlord and renter), other family members, the building, its systems (appliances, lighting, HVAC, etc.), the environment, and the energy supplier. There are certainly other influences on energy usage as well (neighbors, friends of children, work required by employers to be done at home, tiered power prices, etc.). But these are the elements of the core system. In this system, more than people are clearly involved. In fact, the workings of the building, its equipment and natural conditions are all somewhat independent of, and at the same time constraining upon, the homeowner and his/her family's choices and actions. In actor network theory, these "non-human" elements are also considered "actors."

This is a slightly odd use of that term, since it is usually reserved for humans. But there is a good reason for this. It forces the analyst to consider a much wider range of "actors" than he/she might otherwise be inclined to as a social scientist. It requires us to think about the ways in which the characteristics of machines and buildings play important roles in what is going on in the system of interest. It also forces us to think "outside of the box" in other ways—to ask whether other non-human and non-hardware elements may also play a part. The classic example is the role of *rules* and *legal instruments* used to regularize behavior and control technologies and the built environment. These include contracts, building codes, due diligence requirements, appraisal forms, certification, apprenticeship standards, and engineering interoperability standards. Because all of these human and non-human elements are related in some way, and all "act" to some degree within the context of those relationships, they are said to be "networked"—and the entire collection has come to be considered an "actor network."

We could call it something else, and in fact some pretty ugly alternatives (e.g., "heterogeneous system") have been proposed. But "actor network" has stuck. It has the advantage of pointing toward sets of related but also dissimilar elements (again, to human choices and actions, plus technological hardware and software, and rules and standards). The formulation does not require assumptions of rationality, as a neoclassical economic model would. It does not assume the primacy of human choice, as most social and consumer science models do. It is "intervention neutral" in a way that barriers analysis is not (generally assuming "barriers to" something, most often a particular adoption choice or incentive offer). It does not assume that the most important features of the system involve buying and selling, as most market analysis must. So it is a somewhat broader formulation than the alternatives. Whether it is too broad to be useful depends on the analyst and the data (as do all of the alternative approaches). At minimum—and the use of actor network analysis is truly minimal in this study—it cautions analysts to be on the lookout for complexity and the unexpected, but also to be as aware of stabilizing forces as of change agents.

At this stage of ANT's development, there is no established methodology, and certainly no "cookbook" for actor network analysis. There are no established standards for identifying actor network elements, setting system boundaries,

specifying (let alone classifying) relationships, or for depicting networks. In terms of the latter, we have seen everything from complex wiring diagrams to concentric circles with nodes to simple sets of connected symbols (circles, squares, etc) used to graphically "model" actor networks. Several of the examples that follow are pictorial (showing a network "landscape") rather than being formally specified (as in a detailed logic model or process diagram). For the purposes of the AB 549 study, a fairly sparse pictorial representation is most appropriate, and more than adequate. It allows us to identify key actors—mostly human—and to keep in mind their inter-dependence.[2] We do not know enough from either the literature or our brief interviews and panels to pretend that we have more than a rudimentary understanding of network dynamics. However, we have been able to identify salient actors and to gather some insights about them. As a result, we feel that the policy process is better informed than it would otherwise be.

Usefulness of Actor Network Thinking for Energy Efficiency Policy Development

As we have noted, at this stage actor network thinking is most useful as a heuristic or sensitizing device for policy research and policy formulation. Ideas about actor networks can complement, but are not intended to replace, analyses of barriers and market conditions in energy policy work. Each perspective brings different theoretical traditions and analytic approaches to the problem of understanding change in complex market and technology systems.

Some key insights from ANT are particularly valuable in creating an overarching framework for thinking about energy efficiency potentials in the policy context. For example, in complex systems with complex inter-dependencies, ANT would suggest that it is quite reasonable to think about possible "leverage" points—places where strategic changes (e.g., in rules, practices, funding streams, technical characteristics, etc.) could cause cascading effects through the system, creating new contingencies and constraints for actors and altering their energy usage patterns. The simplest of these—and too often the most obvious—is *price*. If energy prices were to rapidly rise, the effects on household and business budgets, rates of efficiency adoption and new technology innovation, new building patterns, etc. would spread and alter the system—although with unwanted harms as well as benefits to people, the environment, markets, governments, and so on. So small changes can, in principle, have large effects if the conditions are right.

However, in complex energy-using systems it is also possible for inertial forces (including the built environment, technologies that are both sunk costs and have to be continuously 'manned,' regulatory regimes, and key actors) to slow, block or even "veto" desired changes. Multiple vetoes are also likely, and sometimes by unlikely actors. For example, a study of government procurement (Kunkle et al. 2000) found

[2] Our earlier report on housing and appliance segmentation identifies many of the technological conditions and constraints that are at play along with the human actors in residential networks (Lutzenhiser Associates 2005).

that no fewer than five different types of organizational actors could block the implementation of green purchasing initiatives, despite widely-recognized organizational and environmental benefits.

This means that energy efficiency policy may have to take multi-pronged approaches, targeting different subsets of actors in networks in different ways. It also means that the *negotiated solutions* that are characteristic of much decision making about technological change may, or may not, involve the actors and considerations necessary to produce a result that significantly alters the system—and reduces its waste of energy. In other words, the solution that's *possible* may not be the solution that actually solves the problem in anything like an optimal way.

In the AB 549 project interviews and panel discussions with industry observers, a range of individuals were identified whose choices, cooperation, and constraints are important to understand in order to gauge the potentials of various energy efficiency interventions under consideration. The five tables below identify the groups that are most important to understand for each of intervention strategies in the areas of: residential and commercial (primarily office) buildings, information and training, upstream interventions, and overarching policy initiatives.

RESIDENTIAL INTERVENTIONS

KEY NETWORK ACTORS	Point-of-Sale: Audits, Energy Rating	Information to All	Whole Building Diagnostic Testing	Equipment Tune-up and O&M Services	Third Party Verification
Appraisers	X				X
Associations	X	X	X		X
Energy Auditors	X				X
Consumers	X	X		X	X
Contractors	X	X	X	X	X
Designers		X			
Energy Effic. Specialist				X	X
Informal Sources		X			
Higher Education				X	
Home Inspector	X	X			X
Homeowners		X	X		
Insurers	X				
Legislature	X			X	
Lenders	X			X	X
Local Authorities	X				
News Media		X	X		
Program Implementer		X		X	X
Raters	X				X
Realtors	X	X			X
Retailers		X			
Suppliers		X	X		
State of CA	X	X			
Trainers			X		
Utilities	X	X		X	X

KEY NETWORK ACTORS	COMMERCIAL INTERVENTIONS			
	Benchmarking	Commissioning, Tune-ups and O&M Services	Audits, Energy Rating - Point-of-Sale	Energy Efficient Commercial Leasing
Appraisers			X	X
Associations		X		X
Building Operators		X		
Building Owner	X	X	X	X
Contractors		X		
Designers		X	X	
Energy Effic. Specialist		X		
Investors	X			
Lenders	X			X
Manufacturers	X			
Non-profits / NGOs	X			
Program Implementer		X		
Realtors		X	X	X
State of CA	X			X
Tenants		X	X	X
Utilities	X		X	X
U.S. EPA/DOE	X			
U.S. Government				X

KEY NETWORK ACTORS	UPSTREAM INTERVENTIONS		
	Branding	Purchasing Standards	Manufacturer Partnerships
Associations	X	X	X
Consumers	X		X
Contractors / Specifiers	X		X
Corporations		X	
Designers			
Distributor	X		X
Local Authorities	X	X	
Manufacturers	X	X	X
Non-profits / NGOs		X	
Non-residential Consumer	X	X	X
Raters	X		
Retailers	X		X
State of CA	X	X	X
Utilities	X	X	X
U.S. EPA/DOE			X

KEY NETWORK ACTORS	INFORMATION & TRAINING INTERVENTIONS		
	Demonstrations and Case Studies	Technical Training Grants	Certification Programs
Appraisers		X	
Associations			X
Building Owner	X		
Consumers	X	X	X
Contractors	X	X	X
Energy Effic. Advocacy Grps.	X		
Energy Effic. Specialist		X	
Higher Education		X	
Local Authorities		X	
Maintenance Personnel	X		
Manufacturers		X	X
Non-residential Consumer			X
Specifiers	X		
State of CA	X		
Trainers			X
Utilities		X	X

KEY NETWORK ACTORS	OVERARCHING POLICY INITIATIVES		
	Demand Response	Insurance	Interagency Coordination
Associations	X	X	
CA ISO	X		
Consumers	X	X	X
Contractors		X	
Distributors		X	
Energy Effic. Specialist	X		
Legislature		X	
Manufacturers		X	
Program Implementer		X	X
Retailers		X	
State of CA	X		X
Utilities	X	X	X

4. INTERVENTION PORTFOLIO

Information to All Homeowners

Sector: Residential

Trigger event: Various

Intervention type: Voluntary

Intervention Description

This intervention focuses on providing key energy efficient technology choice information to all residential households. The information is especially to be provided at various trigger points and events so that the customer has the motivational and decision information they need to make informed choices about energy efficiency improvements. This intervention is not targeted at any specific trigger event, as strategies may be employed at any time, in effect, to manage the population of residential buildings as a "fleet" of buildings with the goal of constantly improving the efficiency of the existing building stock. However aspects of this intervention may be targeted at specific trigger events such as home remodeling or renovation. The information would be provided in customer friendly formats that allow the decision maker to see what benefits can be achieved through the energy efficient practice or decision. The elements of an overall strategy are listed below:

1. Targeting. Target buildings that have the greatest potential for energy savings. Likely targeting strategies include those that have higher than average energy bills and homes in areas of transmission/distribution system congestion. The serving utility would likely be involved in compiling the data required for identifying residential and commercial buildings meeting the targeting criteria. Targeting specific customers should improve the near-term effectiveness of the intervention and provide a framework for gradually ramping up the participation. The data from approximately 2 million home energy audits performed in the past could be mined and used by aggregating it at the census or block level to build a general targeting approach. The audit data often has vintage data for appliances and the older homes that have older systems and represent key targets. Appliance saturation survey data should also be used in the targeting approach when it can be linked to homes or census blocks.

2. Energy consumption feedback. This element focuses attention on providing feedback information on customer energy use that will allow customers to compare their recent energy use to other like customers (e.g., size of house, neighborhood) and to their previous usage patterns. Access to this information can be through the customer service link on the utility website. Special attention should be placed on formatting the energy consumption information to motivate its effective use and to encourage customers to delve deeper (e.g., energy use by end use, ability to compare use before and after an event/purchase of energy using equipment).

Information related to "demand response opportunities" for use during critical electricity system events and for periods of high energy costs could be provided. The information could be presented in a manner that would allow the customer to focus on issues of interest such as energy efficiency potential or climate change issues, with links to more information on topics of interest. The system could be set up to notify customers if their home appeared to be a good candidate for energy efficiency enhancements and then invite them to take appropriate actions or to participate in one or more programs.

3. Energy audits. While California utilities currently offer on-site, internet and on-site energy audits in selected areas, this element would provide expanded home energy audit information to all California households having a utility account. Home energy audits would be provided online in an effective format that would provide immediate information at the customer's first "hit" on the site (once account information is provided), but also would allow the customer to delve deeper to further explore their energy use patterns and options for saving energy. Additional levels of energy audits (e.g., over-the-phone, mail-in, on-site) would be provided to targeted and/or interested customers. The purpose of the audits is to improve awareness of efficiency opportunities and provide referrals to existing energy efficiency programs applicable to the targeted audience, such as home energy ratings, whole building diagnostic testing, incentive programs, direct measure installation programs and demand response programs. Program enrollment would be handled electronically within the audit. For example, a homeowner with an old air conditioner can click and enroll in the HVAC tune-up program or click and sign up for the rebate program for high efficiency AC units. Information from the on-line audit programs can be used to screen customers that might be good candidates for on-site audits, where more detailed measures can be identified.

3. Financing. Connect customers with opportunities for financing energy efficiency upgrades either through existing programs or through a separate initiative. Programs offering financing to residential customers for energy efficiency improvements are not commonly offered through the utility and non-utility programs. This is an area where the Energy Commission might be able to fill a need. While financing initiatives do not typically have large enrollments the services can be offered to those who need it.

4. Energy Efficiency Marketing. Customers would receive marketing materials such as bill stuffers, on-line customer service applications and Flex-Your-Power media campaigns.

Importance of Initiative to California's Energy Supplies

California is the most populated state in the United States with over 12 million residential housing units. Single family units account for 64 percent of the total, or about 7.5 million units. About 5.6 million of these homes were built prior to 1982 and were not subject to stringent energy efficiency standards. Although time-of-sale represents a major opportunity for upgrading the efficiency of these older homes, other strategies are needed to reach the remaining population. Basic consumer

education on energy use, energy efficiency options, and services available in the marketplace, are critical to the success of any energy efficiency initiative targeted to the residential sector.

Coordinating This Initiative with Other Interventions or Activities

Whole Building Diagnostic Testing. Once the decision has been made to improve the efficiency of the home, a contractor may be hired to make the upgrades. Upgrades made from a whole-building perspective will likely result in greater energy savings along with other non-energy-related benefits such as improved comfort and a healthier indoor environment.

Demand response. Audits and efficiency upgrades will likely affect the peak demand of the house. The option of a demand responsive rate structure should be presented to the homeowner as part of an ongoing communication. Improvements undertaken to improve efficiency and reduce peak demand (such as a demand responsive thermostat) may make this an attractive offer.

Coordination. Since this is an "information" intervention, coordination with applicable incentive and direct installation programs offered by the utilities and others will be critical.

Tune-ups and O&M. Tune-ups and O&M are an important service that will be promoted by the audits and information offered through this intervention.

Information, Case Studies, and Demonstrations. Lack of information was frequently cited as a barrier to obtaining audits and undertaking upgrade projects. This initiative should be coordinated with the advertising and marketing campaigns designed to increase the awareness of these options among homeowners and contractors described in the information, case studies and demonstrations initiative.

Organizations, Associations, and Stakeholders Affected by Initiative

A range of individuals are involved in the residential buildings sector, some of whom occupy and manage dwellings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literatures concerning residential energy use and consumer behavior, the following key groups have been identified in the area of energy efficiency information to all.

ASSOCIATIONS – In addition to building industry and specialty contractor trade groups, other sources of consumer information include neighborhood associations and organized interest groups focused on related issues (e.g., environment, climate change). Some homeowner associations also provide information on particular retrofit issues and remodeling related to special housing types (e.g., Eichler, Streng and other "modernist" designs). The web presence of all of these association types

varies considerably, as does the usefulness and accessibility of information on their web sites.

CONSUMERS – Information is needed by consumers to make informed decisions. In most instances, energy information is not readily available to them, and their knowledge of energy use and efficiency options is limited. For information to actually inform action, it needs to be intelligible, relevant, timely, and delivered by a trusted source.

Utility customers cannot use current billing information to estimate how much they might save by upgrading their home or replacing older appliances. Consumer use of web-based energy information is likely growing, but also is likely limited to particular market segments that are also interested in on-line research and bill-paying.

Consumer information about energy and efficiency options comes from many sources besides the utility, including local programs, HVAC contractors, appliance retailers, sources of tax and incentive information, friends and family, etc.

Consumers vary widely in concern, social orientation, income, housing conditions, appliance holdings, age, language, and so on. They are variable in their energy usage patterns, vary considerably in their energy efficiency, and have vastly different energy conservation prospects and perspectives.

CONTRACTORS – In addition to utility companies, likely commercial sources of consumer information include general contractors, designers, architects, realtors, and HVAC contractors—particularly during home renovation projects or at the time of an appliance change-out.

INFORMAL SOURCES – Friends, neighbors, family, and co-workers are often the most available and trusted sources of information about innovation, products, choices being made in the surrounding area. This is likely true of energy efficiency and conservation information as well, particularly in cases where whole house diagnosis and possible retrofits have taken place. The value of this information is not necessarily reliable and accurate.

HOME INSPECTORS – Information provided by home inspectors at the time of sale can be used by homeowners and home buyers direct replacement and/or remediation efforts. Because the new homeowner has purchased this information (paid for the inspection) they are likely to find it trustworthy, and are likely to use it as a “watch list” or improvement list for upgrade decisions.

NEWS MEDIA – The news media periodically report on home energy, efficiency upgrades, green building innovations, solar retrofits, higher efficiency new homes, and related topics, but especially when there it an energy supply emergency or “watch” condition.

PROGRAM IMPLEMENTER – Program implementers generally have to design programs based on general population data and previous program data without the benefit of knowing where their target population lives or how to reach them for efficient service delivery. As a result, their efforts to communicate with preferred customers may not be as effective as possible. As one observer put it: “… [we need to] know more about the home in any targeting effort…. and while there is a wealth

of program and public information (e.g., the census block level data) “we do not use this data well.”

Customers can be grouped in many ways for program targeting, but typically they are segmented by demographic characteristics (income, household composition, ethnicity and race, education, language spoken at home, homeownership, etc.). Unlike the case of commercial marketing, the strategic use of population data sources is uncommon in targeting efficiency programs.

REALTORS – At the point-of-sale, not all information about the house is treated equally. Good features are selling points, while substandard features (e.g., like old appliances) may not be mentioned. In an effort to cultivate future clients (and listings), realtors also often maintain contact with persons they have worked with in the sales process. Realtor newsletters sometimes mention issues related to home maintenance and repair, and possibly energy-related topics.

RETAILERS – Retailers provide potential customers with general energy efficiency information as well as appliance-specific information. Typically, information is collected from customers as well as provided to them during the sales or demonstration transaction. In terms of energy-efficient products, “an incentive is a stimulation message” used by retailers as part of a process intended to move people to retire older appliances.

STATE OF CALIFORNIA – California, operates the Flex Your Power campaign to inform citizens of energy system conditions and energy efficiency alternatives. This high-visibility effort was credited with significant energy savings during the 2000-2001 California energy crisis. Several observers noted that the impacts of information programs are difficult to evaluate, however, and may be likely targets for program reductions. One went into detail, saying that: “Information programs are now viewed as overhead and no energy savings are applied to them. … and they are seen as low performers. Yet they have not been effectively evaluated to get at the impacts of these services.” The California Evaluation Framework specifically addresses the need to quantify the effects from these programs.

UTILITIES – Utilities possess an enormous amount of information about their customers (e.g., usage, appliance stock, shell, demographics, etc). However, to date, there has been little or no uniform effort by the utilities to maximize the use of residential data to address gaps in information related to conservation and efficiency. One observer noted that; “some utilities do target their internal mailing to energy consumers using gross kWhs … but not always and not across all types of programs.” And since the utilities treat most customer information as proprietary, it is has not been available to current program implementers for the purposes of directing limited resources to consumers best suited to their service. As one program operator put it; “… we cannot target our programs to be cost effective because we cannot get the utilities to give us house-specific consumption levels.”

Utilities are heavily invested in their billing systems. They have been designed to provide usage and cost information that is aggregated at the household level. Other information provided on utility bills is either specific to the household (e.g., a chart of monthly usage for the past 12 months) or it is utility-wide, general customer

information. Little effort has been made to provide comparisons to similar households. One observer noted that innovations in billing systems often means that the utility has to outsource their billing services to achieve those ends.

The market actor network diagram for this initiative is shown in Figure 2below:

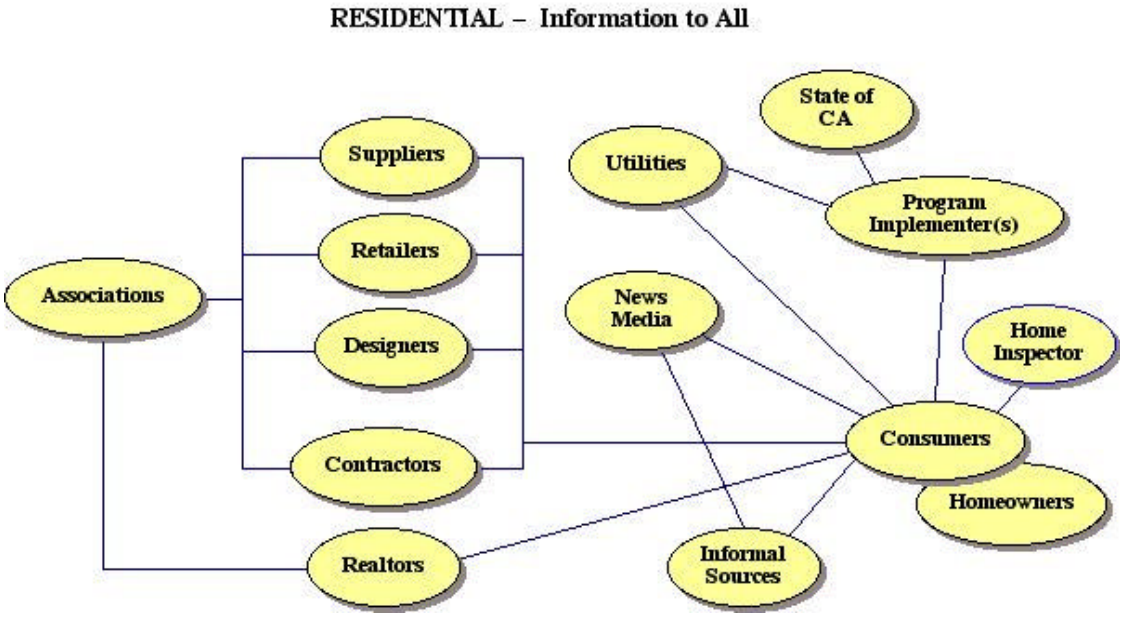


Figure 2. Market Actor Network Diagram for Information to All Homeowners

Market Conditions that will Affect the Success of the Initiative

The market conditions that can potentially affect the success of this initiative are listed below:

Energy Prices. Energy price trends and the implementation of time-of-use electric rates are two market factors that could encourage customers to act on the recommendations provided in their audit report. Rising gas and electric costs will create both a larger financial incentive and also improved cost effectiveness for homeowners to implement energy efficiency options.

Interest Rates. Interest rates affect the ability of homeowners to finance energy efficiency improvements, as well as obtain a favorable cash flow situation.

State of the economy. The general state of the economy may influence the willingness of customers to make energy efficiency investments.

Socio-economic status of targeted customers. Targeted customers may not have the ability to pay for the improvements suggested in the audits.

Program availability. Customers may need financial incentives and encouragement to overcome the first cost barrier of taking the efficiency actions recommended in

their audit reports. Availability of incentives or direct install programs to service customers referred by the program will influence the adoption of measures.

Capacity to provide services. The availability of trained auditors, energy assessors/inspectors and installation contractors is a critical factor affecting how broadly this initiative is implemented.

Availability of materials. If the initiative is rapidly successful there may be a shortage of the energy efficient technologies and products in the market and an over-supply of non-efficient choices, causing a price drop in the non-efficient choice, thereby potentially boosting their market demand, causing more of the lower cost items to be placed in the market. Or, the non-efficient technologies may be sent to other states, with manufactures shipping the efficient technologies to California.

Reduced emphasis on information programs. Information programs offered through utility and non-utility implementers do not receive credit for their associated energy savings. CPUC policy regarding "hard" savings and the role of information programs in the overall portfolio may influence the importance of this initiative. It may be important for policy makers to realized the impact benefits from information programs and to more fully understand their value in the portfolio structure.

Key Barriers Associated with the Success of the Initiative

Barriers associated with the success of this intervention were compiled from the literature and other research. These barriers include:

Lack of information. The primary barrier that this program is addressing is the lack of information or awareness of opportunities that may exist for improving efficiency.

Investment in billing infrastructure. Utilities are invested in their bill processing approaches with millions of dollars in investments and would have to outsource billing to provide innovative meter-interactive billing reports and other information to customers. The utilities may not be in the position to provide these services without large investments in interactive systems. On-line billing can be linked with meter analysis and services. However, utilities currently have very low levels of on-line billing, however, many promote on-line billing because it is more efficient and more profitable. This represents a future opportunity for meter-interactive customer feedback approaches.

Efficiency upgrade costs. First cost is a barrier to many customers. Low and moderate income customers may lack the funds to make efficiency upgrades. Direct installation programs are effective at enrolling these customers and can be cost effective due to streamlined installation and volume acquisition processes.

Trade-off between simplicity and accuracy. Audit products that are too generic do not offer information that is specific enough or credible enough for customers to act on. Utilities currently offer on-line audit programs that allow consumers to assess their consumption and efficiency potentials easily, but in a fairly crude manner. As one observer put it "This is a cheap, effective, screening process that allows contact with people who need services." However, "On-line-audits can often give bad

information and they should let people know that this is a first step in the information process." Follow-up steps need to be fast, cheap and effectives to be successful.

Strategies for Overcoming These Barriers

Strategies developed under this initiative to reduce barriers include:

Provide information. The primary approach is to engage customers in assessing their home's energy consumption and then provide recommendations on the immediate, short- and long-term changes that can be made to reduce energy consumption. A combination of online, mail and in-home audit services is offered to engage the customer at an appropriate level while screening customers for additional services.

Linkage to programs. Information needs to be linked to follow-on services. These services need to focus on providing fast and effective remedies when an audit or information indicates a solution is needed. There needs to be strong linkages to existing programs and services to assist in overcoming first cost barriers, and provide direct installation services as appropriate. The California portfolio needs to be administered as an integrated single service portfolio of solutions, rather than 80+ independent programs.

Financing. Develop strategies in conjunction with the utility and non-utility programs to offer zero or low cost financing for energy efficiency upgrades to compliment incentive programs. Financing programs could be targeted to address localities with peak load problems. Integrate financing options that are available to all programs that have technology installations as the needed action. Work with lenders to develop energy efficient mortgage products applicable to refinancing.

Legislation or Policy Considerations that can Influence the Success of the Initiative

No specific legislation was envisioned for this intervention. Policies that related to the success of the initiative include:

Utility billing systems. This initiative relies on a connection with the utility customer service web application. The willingness of the utilities and/or the ability of the Energy Commission to influence utilities on how to structure their online billing systems will influence this intervention. It may be necessary for the CPUC to order utility information system up-grades that have interactive abilities to better provide customers with energy efficiency information.

Financing policy. Financing is a program gap addressed by this initiative. Utility, Energy Commission and CPUC policy on offering financing programs will affect this initiative. However, financing options should be considered as a portfolio option in addition to specific financing options at the program level.

Title 24. The initiative should target customers undergoing remodeling or renovation projects. Energy Commission policy on extending the reach of Title 24 into remodeling projects and the ability of building departments to enforce the

requirements will influence this initiative. However, every code official should be able to advise or refer contractors or owners concerning energy efficiency options.

Potential for the Initiative to Achieve Market Penetration or Participation

Participation in voluntary home audit programs is on the order of 15 percent - 20 percent, based on the experience with the SCE Home Audit program (Ridge & Associates, 2002). This program uses a similar approach, but covers other information sources and establishes interactive communications across the service portfolio and between utility accounts and the customer's needs. High consumption customers are targeted by mail for audit services and referrals. More aggressive marketing of the offer can improve participation rates and related service linkages and offers can improve implementation rates.

Potential of the Initiative to Influence Energy Savings or Demand Reduction

Measure adoption rates for residential audit programs are on the order of 40 percent - 50 percent, with measures largely self-financed by homeowners (Ridge & Associates, 2002). Stronger connections to incentive programs and financing options, improved follow-up services to audit, improved customer information systems linked to meter reads and building characteristics will likely improve adoption rates.

Residential Time-Of-Sale Energy Ratings

Sector: Residential

Trigger event: Time of property sale (prior to property listing)

Intervention type: Mandatory

Intervention Description

This intervention is designed to bring residential buildings energy characteristics information into the home marketing and sales process, allowing home buyers to understand the energy efficiency of the home before they make a purchase offer. Home buyers shopping for a home need comparative information on building efficiency to assist in their decision process. Sellers of efficient homes will have the opportunity to highlight the efficiency of the home, while sellers of inefficient homes will have the market incentive to improve the efficiency of the home prior to sale. Purchasers of inefficient homes will have information disclosed at the time-of-sale that will allow them to understand the efficiency and efficiency-related costs of the buildings. In addition, the information will help them consider taking advantage of energy efficiency financing and other program participation opportunities. The intervention is designed to take advantage of existing market infrastructure and have

a minimal impact on the normal sales process. It is important not to slow down the sales transaction process that many consider to be too time consuming.

Third party home inspections are used in approximately 80 percent of all residential real estate sales transactions. This voluntary process protects several parties to the transaction. The home buyer has a better understanding of the physical condition of the home and can factor that information into the purchase decision and price negotiations. The seller and selling agent are also protected from possible litigation resulting from non-disclosure of a defect in the home. Home inspectors conduct on-site inspections of characteristics such as the condition of the foundation, structure, roof, flooring, plumbing, and electrical systems as well as the condition of the heating, air conditioning, and water heating systems. The results of the inspection are disclosed to all parties in the transaction. Although home inspections are generally ordered by the buyer, they are also provided by the seller. Home inspectors are currently certified through the California Real Estate Inspectors Association (CRIEA) and are tasked to provide independent assessment of the condition of the home.

This intervention seeks to use the existing home inspection process to conduct an energy inspection/assessment of the home. Important energy features, such as attic and floor insulation levels, window type, type and age of the heating and air conditioning system, water heater, and major appliances, and the characteristics of hardwired lighting systems can be observed during the course of the home inspection. The home inspection is generally limited to non-intrusive, visual observations of the characteristics and condition of the home. These observations can be used to identify major efficiency upgrade opportunities and screen the home for more detailed assessment such as testing the home for envelope leakage, air distribution system duct leakage, air conditioner or furnace efficiency and so on. The costs for or the time requirements associated with a more detailed level of assessment may not be justified in all cases, thus the home inspection serves as a filter for screening homes for more detailed analysis.

Once these data are collected, they can be used to calculate the annual energy cost of operating the home as well as the costs and benefits of efficiency upgrades to the observed systems, and provide a comparative energy efficiency rating of the home under a Home Energy Rating System (HERS) process. Additional information on financial assistance provided by applicable efficiency programs or other financing options can then be disclosed to the buyer with recommendations for what they can do to the home to make is more energy efficient. The financial analysis of potential efficiency upgrades can be used to apply for additional mortgage financing for making upgrades to the home after the sale. Adding the cost of these upgrades to the mortgage has several advantages. The term and interest rate of mortgage financing is generally much more favorable that general consumer financing. The utility cost savings generally exceed the additional monthly payment for cost effective efficiency upgrades, providing immediate net savings for the improvements and better overall affordability of the home. The timing of the intervention is designed to have minimal impact on the sales transaction process and not slow the real estate transaction process. The following are typical steps that can apply to this initiative

- The home inspection, with added energy assessments would be commissioned by the seller prior to listing the home for sale. Scheduling of the inspection and generating the inspection report and energy rating should not take any longer than the current home inspection process in most cases.
- Information on the energy features would be made available to prospective purchasers through the Multiple Listing Service or other marketing and advertising channels.
- The energy features of the home disclosed through the inspection report would be available for consideration by the appraiser.
- Program contact information and enrollment information for energy improvement mortgages, HUD/FHA Title 1 financing[3], and all applicable energy efficiency and demand response programs would be disclosed to the seller, but also to the prospective buyer if requested.
- Information on cost effective energy improvements necessary for applying for an energy-improvement mortgage (EIM) would be made immediately available.
- Once the sale closes escrow, funds from the EIM for the improvements would be placed in a separate account for disbursal after the work is complete. The process of getting bids, selecting a contractor, and completing the work would take up to a year after the closing.

A flow chart of the residential time-of-sale process is shown in Figure 3. Interactions of the provisions of this intervention and other related interventions are shown below:

[3] HUD/FHA Title 1 loans originate after closing and do not require an appraisal.

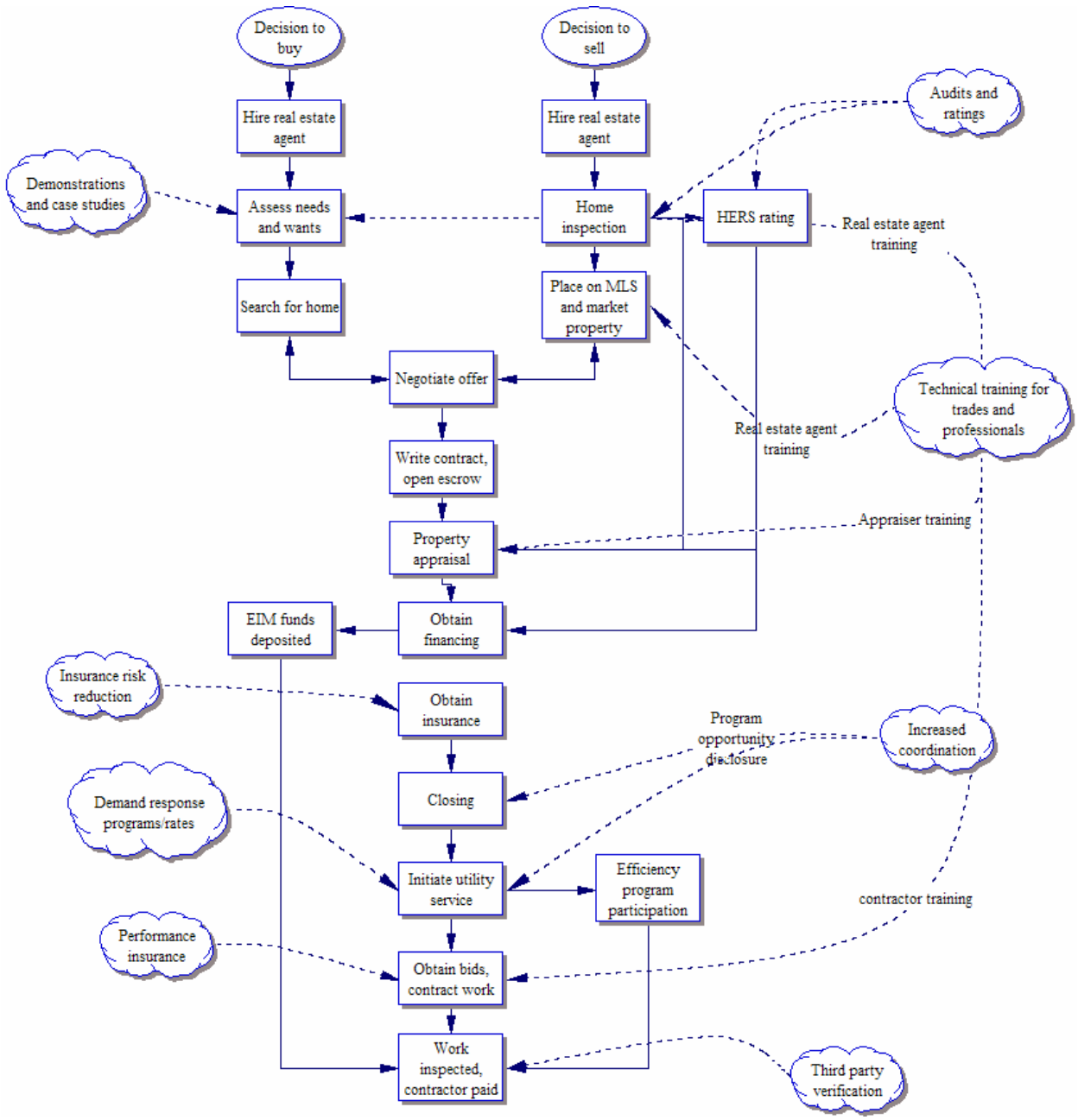


Figure 3. Residential Time-of-Sale Flow Chart

Importance of Initiative to California's Energy Supplies

California is the most populated state in the United States with over 12 million residential housing units. Single family units account for 64 percent of the total, or about 7.5 million units. About 5.6 million of these homes were built prior to 1982 and were not subject to stringent energy efficiency standards. Resale volume for single family residential units is about 640,000 units per year, with roughly 70 percent of these units built prior to 1982. Time-of-sale assessments and linkages to related

opportunities represent a unique opportunity for upgrading the efficiency of the existing housing stock and incorporating the cost of the improvements into a mortgage. Replacement of old, lower efficiency HVAC equipment at time-of-sale could significantly improve energy and demand characteristics of the home. This opportunity can be incorporated into the standard inspection process associated with the sale of a home.

Coordinating This Initiative with Other Interventions or Activities

This intervention will work in conjunction with several other interventions proposed in the project:

Whole Building Diagnostic Testing. Once the decision has been made to improve the efficiency of the home, a contractor may be hired to make the upgrades. Upgrades made from a whole-building perspective will likely result in greater energy savings along with other non-energy-related benefits such as improved comfort and a healthier indoor environment.

Demand response. Change of home ownership generally involves initiating a new utility account, which can be coordinated with program services that offer other efficiency upgrades affecting the peak demand of the house. The option of a demand responsive electric rate structure should be disclosed to the homebuyer both during the sales process and also offered to the customer when a new account is initiated. Improvements undertaken to improve efficiency and reduce peak demand (such as a demand responsive thermostat) may make this an attractive offer.

Information Training and Education. Lack of information was frequently cited as a barrier to obtaining energy ratings and pursuing EIMs. Advertising and marketing campaigns designed to increase the awareness of these options among homebuyers and training and education efforts directed at realtors, lenders and appraisers should be coordinated with current programs or developed if not offered.

Organizations, Associations, and Stakeholders Affected by Initiative

A range of interest groups are involved in the residential buildings sector, some of whom occupy and manage dwellings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literatures concerning residential energy use and consumer behavior, the following key interest groups have been identified in the areas of energy audits and ratings of residential buildings.

ASSOCIATIONS – There are a variety of trade groups representing the interests of various professionals and businesses involved in real estate transactions, energy services, finance, etc. These groups provide market trend information, training, certification, policy analysis, and lobbying on behalf of their members. Important

trade associations in California represent realtors, contractors, lenders, appraisers, home inspectors, energy services providers, organized labor, and local government. All can provide support for energy efficiency policies. Some can lobby effectively against changes (e.g., that would materially change and/or slow the transfer of real estate, or might be construed as "an unnecessary intrusion into private lives"). Key observers stressed the importance of "buy-in" by various industry groups as essential to the success of this initiative.

APPRAISERS – The appraiser is considered the field representative of the lender. Currently the appraiser has little or no role in assessing building energy efficiency. Appraisals are ordered by lenders and increasingly do not involve in-depth on-site investigation (an increasing number are "database driven," relying on data collected previously and for other purposes). In determining dwelling value relative to "comparable sales," appraisers could consider energy efficiency "if the information is available." They would be able to fairly readily incorporate that sort of information into the appraisal process if inspection information were available, and appraisers would likely not object, "particularly if it were recognized or requested by the realtors." Appraisers are now required to take continuing education every four years, which is being "pushed up to every two years in some areas." This training can include energy efficiency assessment methods.

ENERGY AUDITORS – When hired by a homeowner or prospective buyer (rare occurrences), the auditor evaluates building systems and shell conditions and "basically … starts the engine …[telling] the customer everything that's wrong, and who to call if they choose to do so." Auditors have a strong interest in having every home be inspected at the time-of-sale or having a referral service so that they can be called in if a preliminary real estate appraisal notes improvement opportunities.

CONSUMERS – Consumer demand decisions drive the actions of all service providers in the market. This means that consumers are "important players" in energy efficiency market, particularly since "some of the greenest consumers will purchase products based on their energy-related environmental benefits." However, consumer knowledge of energy efficiency, building efficiency potential and energy systems is quite limited. One panel member interviewed for this project noted that "people genuinely want to do things to improve their home, but are uneducated about what to do." Consumers also see energy supplies and prices as long-term problems, but access to efficiency-related information in general is limited. Trust in contractors and providers of unfamiliar energy services (e.g., energy auditors or raters) is not high in many cases. The home inspector, as an impartial third party, may be an exception to this rule. Stakeholders report that home energy inspections are not typically ordered in the transaction process, and when they are, they are typically ordered only after the buyer has made or is close to making a decision.

Consumers have developed some level of trust in the Energy Star brand. Also, there seems to be some levels of trust in the Flex Your Power campaign, and with local programs and utility programs. This trust should be used at the time-of-sale.

CONTRACTORS – Contractors are in the business of providing product installations and property up-grades of various types. In a small percentage of cases these are

accomplished as a result of an energy audit or an energy-related assessment. A few contractors can provide energy or energy-related assessments and make recommendations that when taken can reduce utility costs. Contractors that can have an effect on the energy efficiency of a home include: general contractors, remodeling specialists, HVAC, electrical, and plumbing contractors. However, these contractors do not often see a need to change their business approach to provide services that focus on energy efficiency up-grades without some sort of a market push to create the demand for energy efficiency across a wider market.

HOME INSPECTOR – The home inspection is a routine part of the home buying process, the inspection of the building, appliances and home condition is viewed as a buyer's right. The inspection is usually conducted by an independent "home inspector." The inspection process investigates a large number of shell and system elements. However, energy performance analysis is ordinarily not included in this assessment, leaving the buyers unaware of the energy efficiency of the home (exceptions are found in at least one local demonstration program that supplements routine inspections with energy efficiency inspection items).

However, the home inspector is typically never called to assess a home that is being sold and when they are call is typically "one of the last people to enter the transaction process, often after the deal is made." Home inspectors do not rating buildings, but rather point out defects and potential non-energy problems. "Typically the buyer' broker orders the home inspections and they usually request it as part of their offer." However, there are "more pre-offer/pre-sale inspections being done" as well. But again, these do not assess energy efficiency, but only point out significant problems.

INSURERS – Providing coverage and setting homeowner insurance rates will take building conditions into account. However, these condition typically focus on smoke alarms, sprinklers, security systems, alarms, and other such items. At this point, an energy system or appliance would only be considered in the insurance calculus if the equipment was significantly outdated to the extent it is a safety factor or is potentially dangerous.

LEGISLATURE – The Legislature often sets policy context and provides regulatory authority for state and local government agencies. The Legislature can however, provided tax and other incentives for energy efficient equipment and renewable energy technologies and can set inspection policy to include energy efficiency assessments so that the buyer is aware of the energy-related conditions of the home.

LENDERS – A number of interviewees noted that it is important to work with lenders to try to get them involved in energy efficient transactions and conditions, but also noted that it is difficult to get them involved in these aspects. The lender supplies financing to home buyers and in the process imposes a number of requirements on the transaction to minimize risk and reduce the potential for loss (e.g., from default, hazards, etc.). However, the lender is also subject to a number of influences from other parties. One observer noted that "the lender, in essence, works for the realtor rather than the other way around." What this statement means is that the realtor will

often recommend a lender to a buyer. As a result the realtor is a valued customer of the lender. This relationship can be used to help move lenders interests. The real estate transaction process is highly structured, with inflexible time lines as a result of the financial system's efforts to minimize risk from constantly changing interest rates and costs to the lender (and buyer) for borrowed money. One observer noted "you're dooming yourself … if you try and figure out a way to get to the front of the line at the escrow." Lenders are also strongly dependent upon, and influenced by, the secondary mortgage market and national regulators. For example, one market actor observed that "HUD could put pressure on Fanny Mae to generate a certain number of energy efficient mortgages and that would produce a tremendous amount of results, that would vibrate through the lending community and all of a sudden you'd see a tremendous changeover."

However, HUD does not see this as one of their key objectives. "Most of the federal guidelines from FHA, VA or Fanny Mae/Freddie Mac … put the transaction power in the hands of the underwriter. The underwriter must use whatever information they can obtain including energy efficiency information. If the underwriter had information from which to base an energy-related financing decision, they could use it to help guide the rates and payment structure to include the efficiency up-grades in the agreement. There are also jumbo lenders who are working outside of the Fanny and Freddie limits who may need to be pressured to include energy efficiency up-grades in the deal when it is cost effective and lowers monthly payments and loan risk.

Lenders are also influential in the time-of-sale transaction. They possess information that others do not. They ultimately have the power to move the sale along, and they can represent a trusted source of advice to borrowers. "Loan officers can be influential at the point of sale and throughout the loan process. They also act as an information source to realtors: "The realtors are often educated by the loan officers they work with about what rate products are available."

There are three major types of lenders: savings and loan associations, banks, and mortgage brokers. Many loans processed through the first two types are actually produced by mortgage brokers.

LOCAL AUTHORITIES – Local governments (cities and counties) regulate building practices and issue permits for new construction and major renovation/remodeling projects. Salient officials include building inspectors and planners. Some local governments also operate energy-related programs. Others function as electric utilities selling power as well as issuing permits. They generally represent a trusted source of information about home improvement options.

RATERS – When (generally new) homes are assessed for energy-efficiency for purposes of securing energy improvement mortgage benefits, certified energy raters are employed to conduct the assessments. This group of professionals represents a resource that can be used and expanded to provide home energy assessments at the time-of-sale, or provide follow-up detailed assessment when an time-of-sale energy assessment indicates a problem that needs professional investigation. Several individuals interviewed noted that "If the rater is separate from the home inspector that is where the costs jump up to a degree."

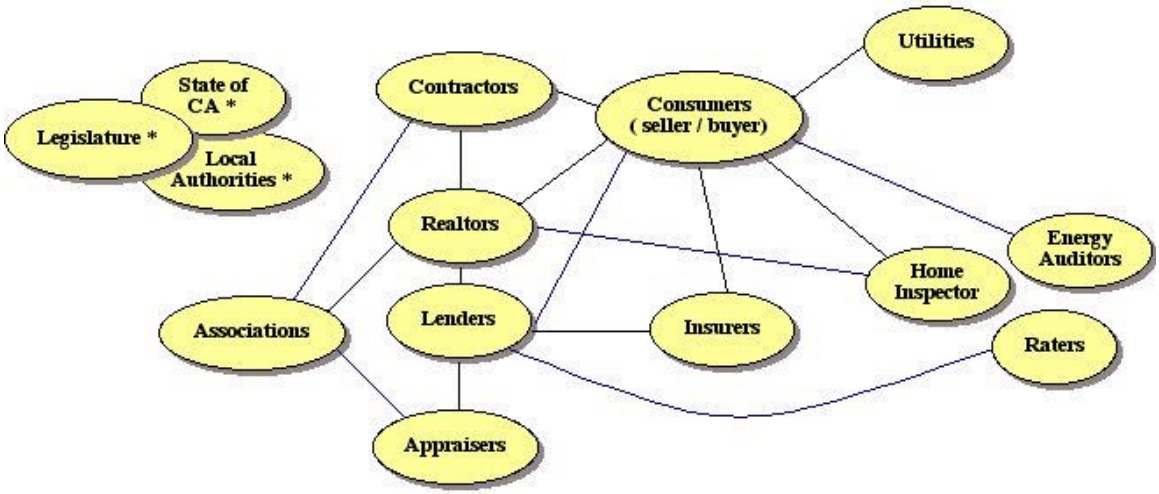
REALTORS – There are a large number of realtors working to connect buyers with sellers within the existing homes market. Because of their large numbers, the area over which they are dispersed and the independence of their operations, it has been difficult to get them involved in past energy efficiency initiatives . Realtors control consumer access to listings, establish personal relationships with sellers and buyers, manage the intricacies of the real estate transaction and manage the emotional dimensions of the transaction. At the same time, realtors have significant legal obligations to discharge their responsibilities effectively and professionally, and are guided by prescribed procedures for representing the buyer's or seller's interests and the disclosure of pertinent information. If the realtor knew that there were energy efficiency issues with a home they may be required to disclose that information, thereby supporting the goals of this initiative.

STATE OF CALIFORNIA – The Department of Real Estate (DRE) licenses brokers and realtors, and provides oversight of training and best practices. They would have an interest in an effective statewide time-of-sale initiative.

UTILITIES – The electric and natural gas utilities have the most fundamental relationship with customers, as providers of basic utility services. They deliver energy resources on a continuous basis, deliver monthly bills, deal with outages and equipment safety issues, and represent a generally trusted source of information about energy usage, conservation options, prices and rates, and renewable energy alternatives. This relationship should be put to use in establishing an initiative, especially as an information source to their customers.

The interactions of these interest groups are shown in Figure 4 below:

RESIDENTIAL – Point-of-Sale: Audits, Energy Rating



*** Regulatory linkages throughout, therefore, not drawn.**

Figure 4. Residential Time-of-Sale Market Actor Network Diagram

Market Conditions that will Affect the Success of the Initiative

Market conditions that can affect the success of the initiative are listed below:

Home sales market activity and competitiveness. Active real estate markets place additional pressure on the sales process, which could further inhibit the inclusion of home energy ratings and EIMs due to real or perceived time constraints. EIMS provide a loan qualification and structure approach to fund the additional energy improvements. Lenders in a competitive market may already be willing to make that stretch to qualify more buyers. However, in a very active market items that act to increase the pressure on the process, add time or costs to the process may not be seen as smoothing the transaction process. On the other hand, if demand were generated via an information program, the market pull could be expected to help add a level of differentiation to the services offered.

Home prices, affordability. As home prices continue to rise and housing affordability becomes a bigger issue, the viability of HERS and EIMs as a means of increasing affordability becomes more important. The buyer is able to buy more of an energy efficient home than they can if the home is more costly to operate. This is an important element to be communicated to the public.

Interest rates. Higher interest rates place more pressure on home affordability. As interest rates move up, there is more of a need to minimize operational costs in order to be able to afford the payments.

Energy Prices. Increasing electric and natural gas rates improve the cost effectiveness of energy efficiency measures.

Capacity in the industry. At this time energy ratings and EIMs represent a small fraction of the market. Significant capacity will need to be built to service widespread adoption of these services. The expansion of energy-related inspections and the ability to process energy-related loans will require adjustments in these service structures.

Key Barriers Associated with the Success of the Initiative

Barriers associated with the use of this intervention were compiled from the literature and other research:

Cost of ratings. The cost of a home energy rating was cited as a barrier. The cost of the rating, which is usually borne by the buyer, was cited as a barrier to pursuing and obtaining a rating; which then precludes applying for an EIM. Purchasers also resisted the relatively modest incremental cost of adding an energy inspection to a standard home inspection report. These costs are negligible in the context of the cost of the home when rolled into the purchase price and/or financed through the mortgage, however, unless subsidized in some way, these costs will show up as an added cost in the transaction process. The costs of the rating may need to be rolled into the loan amount as an option for the buyer. The inspection should also be

established as a opt-out part of the transaction. That is, the buyer must specifically check a box on the loan application form that indicates that an energy inspection is not requested by the buyer. If the opt-out box is not checked then the inspection would go forward.

Rating report complexity. Feedback from homeowners suggests that the energy rating reports are too long and complicated. Homeowners suggested improving the information on energy savings and costs to make the report easier to understand. The buyer just needs to know if the home/equipment is efficient, and if not what they need to do lower ownership costs, what it would cost, and how much they would save by taking the actions.

Lack of time. The process of obtaining a home energy rating and applying for an EIM takes more time. The real estate market is not supportive of any requirements that add time to the transaction. The energy-related inspection must not lengthen the time between the acceptance of a offer and the closing date, not by even one day.

Lack of information about ratings and efficiency upgrade options. The general public is not well informed on what can be done to improve their home in terms of energy efficiency. Homebuyers cite a general lack of information about energy saving opportunities, a lack of specific information about what needs to be done, and a lack of information about how changes should be made or who to contact. These information barriers have the affect of lowering penetration rates and delaying transaction processes. There is a need to educate home buyers that energy consumption is a manageable aspect of the home and the home can be cheaper to buy if it is efficient.

Lack of information about energy efficient mortgages. Homebuyers generally look to their realtor and then to the loan officer for information about the home purchase and financing process. Realtors and lenders may not know about EIMs, or if they do, they may not have sufficient information to direct homeowners to the appropriate resource. In this situation, a standard loan option becomes the path of least resistance.

Lack of market viability for service. Although homeowners are resisting the costs of a home energy rating, home energy raters are having a difficult time staying in business on what they can charge for a rating and the number of ratings that are requested. Due to a lack of sustainable market support for the home energy ratings, many raters are forced to do other types of work besides energy ratings. Energy rating services are often a low-profit line that is offered with a set of other services in order to be profitable. Prices paid for providing audits and energy ratings that are set to induce consumer participation may be set too low for service providers, and not yet seen as a high-value items by the homeowner.

Lack of proof that concept works. There are few success stories in the marketplace for home energy ratings and energy improvement mortgages. Similarly there is a lack of information and case studies on the effectiveness of energy efficiency upgrades. This is not a barrier that the mortgages and assessments are not valued when competed or do not work but that these topics are not placed in social information systems and market networks do not often function about these

subjects. People do not talk with their neighbor about the conditions of their loan agreement or the need for up-grades to their home to be less costly. Without an information push to move this information in the market there will be limited examples of this concept within social networks.

Lack of realtor support. Realtors may generally view home energy ratings and energy improvement mortgages as another step in the way of completing the sale. Many often do not understand the benefits to their customers and do not recommend or support buyers that investigate these options. Realtors generally work closely with a particular lender and the lenders suggested by the realtor may not offer loan products that support EIMs. Lack of buyer interest in energy efficiency and EIMs feeds the lack of interest on the part of realtors to promote these services.

Lack of familiarity with EIM process. Loan officers may not have experience with applying for EIMs, or have an impression that the application process takes too long or complicates their job. EIM facilitators, who are familiar with the process report that they can process the paperwork in minimal time. These facilitators may not be available to recommend EIMs to buyers. Loan officers at the local level may support the EIM products but face opposition from officials higher up in the organizations who may look at this as one more thing to keep track of and to overcome.

EIM limitations. EIMs are available through a limited set of loan options. Loan products such as interest only mortgages and adjustable rate mortgages may not be available with EIM options. Lending limits on products available with EIM options may be set too low for California markets. The additional funding available through the EIM process may not be sufficient to cover the cost of improvements that are otherwise cost effective. Homebuyers in strong real estate markets may try to pre-qualify for a loan to make their offer more attractive to a seller. The pre-qualification process may not consider loans with an EIM option.

Strategies for Overcoming These Barriers

Strategies that can be considered to mitigate the barriers cited above include:

- Increase the pull for EIMs by instituting an EIM loan portfolio standard. EIMs are inherently less risky loans and strengthen the portfolio of loans on existing buildings. The secondary lending market should be encouraged or required to maintain a minimum number of EIMs in their portfolio.
- Provide incentives directly to raters to buy-down the cost of ratings to consumers. Also, consider incentives incorporated into each rating report so that if the owner moves forward with a recommendation they can apply for the incentive. Allocate the incentives based on the type of rating, depending on whether the homes are new construction or existing housing stock. Allow the costs to be added to the mortgage.
- Offer financial incentives for energy-efficient financing (mortgages or loans) for mortgage borrowers. Offer a slight interest rate break for EIMs (on the order of a quarter-point mortgage interest rate reduction) to make these mortgages more attractive to borrowers.

- Provide financial or regulatory incentives for lenders to establish and market EIMs. Make EIM attractive to the lenders.
- Help strengthen the financial viability of rating organizations. Organizations that combine their home energy rating services with other services may increase the probability of their viability. Help make ratings a profit center for the raters rather than a marginally profitable or unprofitable task.
- Increase promotion of ratings and EIMs to buyers who demand the service and realtors who exert significant influence over the sales process. Provide promotional materials to the real estate community when partnerships can be established.
- Provide more EIM facilitators, and streamline the EIM application process.
- State agencies that purchase mortgage loans should insist that the primary market offer EIMs and that the loan portfolios have a minimum EIM investment.
- Simplify the EIM process. In addition to training, provide simplified materials that agents can use to facilitate EIMS, such as a simple and easily accessible one-page sample of what qualifies or a business card sized reminder with the ten points an agent needs to know.

Legislation or Policy Considerations that can Influence the Success of the Initiative

The intervention consists of a number of elements, some of which are voluntary and some of which may be mandatory. Those we spoke with during the course of the interviews and expert panels favored a voluntary approach, with pilot programs developed in areas receptive to this type of intervention. Specific legislative recommendations included:

- Minor change to the statutes governing home inspections. Section 7195 of the Business and Professions Code governs home inspections. Subparagraph 2 governs energy inspections, and defines what constitutes an energy inspection. Energy inspections are an optional component of a home inspection. Making energy inspections a mandatory component of home inspections, while keeping the home inspection process voluntary will dramatically increase the number of energy inspections conducted. However, mandatory inspections should be considered if California wants home buyers to be well informed about the energy efficiency and energy needs of homes they purchase.
- HERS proceeding. The Energy Commission is encouraged to conclude the proceeding on home energy rating systems. This will define a standard and consistent process for home energy ratings across California.

Potential for the Initiative to Achieve Market Penetration or Participation

Some experience with time-of-sale energy inspections and energy ratings has not been positive. In a recent market-based program in Northern California, homebuyers were reluctant to spend an additional fee to have the energy inspection done, with 205 energy inspections completed out of a planned 12,000. In a program in Southern California, a modest rebate of $35 paid to the inspector was successful in getting 27,000 energy inspections completed. Consumer resistance to the higher costs of a home energy rating is a significant barrier, along with the time required to obtain the rating. Based on prior program experience, offering an incentive to buy down the cost of the energy inspection will increase market penetration and stimulate the market. Making the energy inspection a mandatory part of a home inspection will of course increase the market penetration dramatically.

Potential of the Initiative to Influence Energy Savings or Demand Reduction

Average savings for participants in the home inspection program in Northern California for electricity consumption, demand and gas was 395 kWhs/yr, 0.2 kW, 38.5 therms/year per home respectively from measures that were entirely self-financed. Stronger connections to incentive programs and EIMs should increase the expected savings per home. Estimated energy savings for homes going through the full home energy rating process is on the order of 1100 kWhs/yr, nearly 3 times higher.

Residential Equipment Tune-ups and O&M Services

Sector: Residential

Trigger Events: Equipment replacement, time-of-sale, service call.

Intervention Type: Mandatory

Residential space cooling represents roughly 15 percent of California peak electrical demand. A significant factor affecting residential air conditioner demand is the inefficiency of old equipment as well as performance issues related to equipment that was improperly installed or serviced. Once installed, residential HVAC and other energy consuming equipment (e.g. pool pumps) are generally ignored unless there is a catastrophic failure. This is due to a variety of factors including:

- Lack of occupant knowledge of expected equipment performance,
- Inability of owners to evaluate performance,
- A general lack of confidence in the service industry to effectively identify and remedy equipment problems, and
- A general perception that equipment performance is defined by the nameplate rating, not by how it was installed.

Equipment performance problems are compounded by an installation and service industry that relies on approximate (and often inaccurate) rules of thumb for commissioning equipment. The highly cost competitive replacement and service markets use these rules of thumb as a rough indicator of installation quality with little meaningful performance data obtained and recorded. It is very difficult for the homeowner to gauge how well their HVAC system is operating. Their perception is if cool air is supplied from the registers and comfort is generally being maintained, the system must be operating properly. (Interestingly cooler air from registers could be symptomatic of a problem such as reduced system airflow, a phenomenon that reduces cooling system capacity and efficiency.) Equipment failure problems are frequently the only time a service call is initiated.

This intervention strategy looks at improving how the HVAC and related industries interact with their customers. By increasing the training and certification level of contractors, educating consumers about issues and solutions, and providing long-term program support through incentives and training, this initiative aims at transforming the residential tune-up and O&M market. A mandatory requirement for these services is the logical approach since a properly installed and maintained system will offer lower life cycle costs than an improperly installed and more frequently serviced system. This initiative is primarily directed at HVAC services and would address airflow requirements, refrigerant charge, and duct leakage. This intervention is particularly attractive for multi-family applications where the cost per transaction can be much lower than in the diffuse single-family market.

Importance of Initiative to California's Energy Supplies

California is the most populated state in the United States with over 12 million residential housing units. Single family units account for 64 percent of the total, or about 7.5 million units. According to the Energy Information Administration, approximately 65 percent of California households have central air conditioning and would therefore be candidates for this initiative. Given this huge market, the potential for energy and peak demand savings for California is significant. Residential cooling is a large piece of California's peak electrical demand and most residential air conditioners are operating at less than optimal performance due to a combination of installation problems and other factors degrading performance over time. This intervention has a peak load coincidence associated with it, making it attractive from a program cost effectiveness perspective.

Coordinating this Initiative with Other Interventions or Activities

Residential equipment tune-ups and O&M is an important intervention that requires the support of other initiatives to achieve its full potential. Specific initiatives include:

Information to All Homeowners. Educating consumers is essential in generating a market for this service. Consumers assume that their equipment is operating efficiently if it meets their comfort expectations. Without knowledge of what is entailed in a quality installation, homeowners and multi-family property owners are content to accept current performance as adequate. Utilities, as a respected entity

for homeowners, can play a central role in education. Contractors also need to be educated on the benefits of offering a superior service to their customers. Currently most contractors compete solely on price, with service calls and tune-ups at the low profit/low skill end of what they offer. A segment of the HVAC service industry will see the financial benefits in differentiating themselves from their competition.

Interagency Coordination. Utilities should play a prominent role in providing information to the marketplace and providing training services to contractors. Third party providers represent a cost effective option for implementing programs working in conjunction with the utilities, the CPUC, and certification organizations.

Audits and Energy Ratings. Single family home audits and energy ratings completed at the time of sale represent an initial screen on determining what type of equipment is installed in a house, as well as the vintage and nameplate efficiency. A simple audit procedure completed at time-of-sale could serve as a flag for pursuing an equipment tune-up or a more rigorous approach such as whole house diagnostic testing and remediation.

Technical Training and Certification. Developing a trained work force to implement this intervention is critical. Currently there are only about 600 NATE certified HVAC technicians in California. By building a market-pull approach, contractors will see a demand for skilled services in the field.

Demonstrations and Case Studies. Case studies of successful tune-ups and O&M efforts are an important part of the Information to All intervention. Documenting the "before and after" impact of a neighborhood or locality-wide tune-up effort could be effective at conveying to the public what the broader effect of this intervention.

Demand Response. Demand response initiatives can play a synergistic role with this initiative. Time-of-use or real time pricing coupled with a "tuned up" air conditioner improves the ability of programs to use smart thermostat technology or cycling programs while better maintaining homeowner comfort.

Branding. Branding can play an important role in promoting the intervention by tying the initiative with a known commodity. Energy Star co-branding would be an effective means of communicating the value of a certified HVAC tune-up or equipment replacement to the consumer.

Organizations, Associations, and Stakeholders Affected by the Initiative

A range of interest groups are involved in the residential buildings sector, some of whom occupy and manage dwellings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literatures concerning residential energy use and consumer behavior, the following key groups have been identified in the areas of equipment tune-ups and operations and maintenance services.

CONSUMERS – Homeowners and renters are generally not well informed about their building systems and operation and maintenance issues. They have misconceptions about equipment, as well as about contractors (e.g., thinking that one is as good as another). Consumers are also less concerned about energy costs than other energy-system-related issues (e.g., health and comfort). They look first and foremost to the utility for information, as well as to some contractors.

CONTRACTORS – Most contractors are not trained or equipped to provide state-of-the-art residential equipment performance assessment and fine-tuning. A handful of contractors are however very committed to a building science approach to O&M and are successful in providing high quality services. However, this requires more effort and use of skilled personnel than can normally be applied in the cost competitive HVAC market. Cost competition is a major impediment for these contractors. In many cases, the contractors have found ways to contact and establish lasting relationships with customers through their own marketing and customer satisfaction efforts.

ENERGY EFFICIENCY SERVICE PROVIDERS – There are several CPUC third-party public-purposes programs that are working with contractors who understand this market. These firms have experience in this field and have a stake in the market and incentives. This stake in the industry can help assure that a broader intervention will not to fail. They may have the ability to implement these programs more cost effectively than the utilities, but may also not be able to wind the programs up to a statewide effort as quickly as the utilities.

TRAINING AND CERTIFICATION – Community colleges and technical training programs provide basic education related to building science, HVAC technology, energy auditing, etc. The training infrastructure is not very well developed compared to other education areas. This is due in part to the higher costs of technical training (requiring labs, shops and hands-on learning opportunities) and to the limited demand for trained technicians during the past decade of relatively low energy prices and less concern for energy efficiency in the business, government and consumer sectors. North American Technician Excellence (NATE) could logically become the certification mechanism for this initiative. On the contractor level, it is reasonable to expect that not all contractors will pursue the training and certification requirements entailed in this initiative. Only progressive contractors and those contractors able to see value in differentiating themselves from their competitors will likely follow this path.

LEGISLATURE – The legislature makes laws regarding building and equipment standards (e.g., Title 24). The legislature could legislate energy efficiency inspections for houses at time-of-sale and/or during major equipment installed for retrofit.

LENDERS – Home improvement loans can be made available by a wide range of lenders in order to finance energy efficiency upgrades.

PROGRAM IMPLEMENTER – Information program providers (e.g., California Flex Your Power campaign) offer a range of specific messages and information to the customer on energy problems and conservation/efficiency options. These efforts

could include real world data as well as examples and case studies ("success stories").

UTILITIES – Although utilities can be reluctant to associate themselves with particular programs, approaches or contractors, they typically have established consumer trust and can therefore play a key role in building a program. California utilities would likely be more active participants in this initiative since the benefits have a significant peak load component. Utilities could be active in training and disseminating information to the public.

HVAC INDUSTRY. This initiative will have a significant impact on the HVAC industry, from individual manufacturers, to trade organizations such as the Air-Conditioning and Refrigeration Institute (ARI), to certification groups such as North American Technical Excellence, Inc. (NATE), and ultimately to individual contractors. In response to this initiative, individual HVAC manufacturers would need to enhance their training programs, in terms of service offerings and in their operation and installation manuals. They would also need to beef up their field training efforts. ARI, as the major industry trade group, would be actively involved in the development and advancement of this initiative.

If successful, the impact of this initiative will grow in the market as other organizations partner with the California strategy to further leverage the initiative. These organizations could include the U.S. Department of Energy, the Consortium for Energy Efficiency (CEE) other state energy organizations such as NYSERDA (New York State Energy Research and Development Authority), FSEC (Florida Solar Energy Center) and ASERTTI (Association of State Energy Research and Technology Transfer Institutes) and its other members.

The market actor network diagram for this initiative is shown in Figure 5 below:

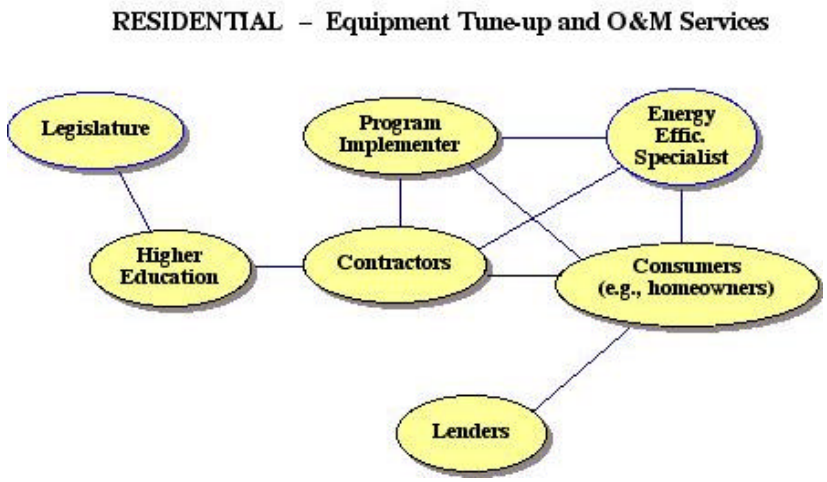


Figure 5. Market Actor Network Diagram for Equipment Tune-up and O&M Services

Market Conditions that will Affect the Success of the Initiative

There are a number of market conditions that will affect the success of this initiative. These include:

1. Available Information. A coordinated "Information to All" effort is a critical component in the success of this intervention. This effort would play a vital role in defining issues related to installation problems and documenting projected energy and demand benefits of a tune-up and O&M program. Field data collected before and after the intervention would be especially valuable in conveying program benefits to the general public.

2. Long Term Approach. A focused, long-term approach to this intervention is needed to send a consistent signal to the marketplace and give contractors assurances that investments in service provider training will result in increased revenue down the road. A well designed program should be implemented on a small scale and fine tuned before being expanded into the broader market. Early feedback should be used to optimize the implementation of the program. The program should have a strong quality control component to closely monitor results and identify contractors not meeting the project standards. Contractors will likely be hesitant to embrace the intervention approach without an extended project duration that would make the intervention worthwhile for them as a business venture.

3. Energy Prices. Increasing energy prices and the implementation of time of use electric rates are two market factors that would help spur this initiative.

4. The Consortium for Energy Efficiency (CEE), along with Air Conditioning Contractors Association (ACCA) is sponsoring a national initiative on residential quality installation (QI). The success of this initiative and the spillover into service and maintenance activities will affect this initiative.

Key Barriers Associated with Success of the Initiative

There are several barriers that currently impact the potential effectiveness of the proposed intervention strategy. These include:

1. Lack of expert advice and information. The residential customer needs better information to understand what factors affect HVAC system performance and how there system is performing. Only as an educated participant can a homeowner know what to ask for and how to interpret verification results the contractor is collecting. Once the homeowner or building owner is educated, they will likely look for the trained and certified HVAC service technician.

2. Lack of HVAC service technicians. The HVAC industry as a whole is experiencing a labor shortage. In this environment it is difficult to retain qualified workers to either train new recruits or to advance their own skills.

3. Lack of trained field personnel. Although there is a mechanism in place to train contractors, strong market-based demand for services does not currently exist. When the marketplace is competing almost exclusively on initial cost, it is difficult for a contractor to increase the training of their employees for services that go beyond first cost concepts. In a differentiated market, the trained contractor would be valued more highly, increasing the value of his services.

4. Nature of the HVAC service/equipment replacement cycle. The residential retrofit and service HVAC industry is characterized by seasonal cycles. In peak times, contractors are unable to keep up with demand and their goal is to install or service equipment as quickly as possible. Most equipment is installed (and serviced) during these frenzied times, resulting in additional problems relating to the quality of the installation effort to be addressed at a later time when time pressures are reduced.

5. Program cost. To properly implement a program will require significant time and money. A long-term commitment is needed to provide an educational foundation to the public, convince contractors that the intervention will exist year after year, and to complete the hundreds of thousands of tune-ups and other remediation measures that need to be done. A program of this type will run into the tens of millions of dollars.

6. Historical lack of long-term planning: A focused, long-term approach to this intervention is needed to send a consistent signal to the marketplace and give contractors assurances that investments in service provider training will result in increased revenue down the road. A well designed program should be implemented on a small scale and fine tuned before expanded in the broader market. Early feedback should be used to optimize the implementation of the program. The program should have a strong quality control component to closely monitor results and identify contractors not meeting the project standards. Contractors will likely be hesitant to embrace the intervention approach without an extended project duration.

Strategies for Overcoming these Barriers

The barriers to implementing a residential equipment tune-up and O&M intervention strategy are significant. The HVAC industry is firmly entrenched in a first-cost competitive environment where life cycle costs are typically not considered. For this intervention strategy to succeed, progressive contractors need to be able to achieve market share by offering a better product with that higher price. For the market to desire improved service and installation practices, consumers and building owners must be made aware of what makes a good installation (or service call) and how to gather the data to evaluate the procedure.

Expanded community college and vocational school training is a critical element for quality entry level HVAC installers and service technicians. Educational tax credits could be implemented to support this effort. Utilities and organizations such as NATE could collaborate to provide training and certification for the advanced HVAC

technicians. Co-branding with Energy Star or Flex Your Power would send a powerful signal to the marketplace.

Utilities, third party implementers, and contractors would all benefit from an intervention strategy that has a longer program commitment period, compared to traditional program cycles. A longer term planning horizon is essential for developing an effort that includes consumer education, training and certification, and marketing efforts. Long-term program planning conveys confidence to the HVAC service industry that the initiative is fully supported.

Utilize existing energy media avenues (utility resources, Flex Your Power) to further educate the market on the factors affecting residential air conditioner performance and what can be done to improve system performance. Case studies documenting "before and after" performance are useful tools.

An HVAC equipment surcharge at the distributor level could be added to the price of air conditioning equipment. If the equipment is installed per the required installation standards, the HVAC contractor would be directly reimbursed. If not, the money could be used to fund training and certification efforts.

Market Conditions that Support the Initiative

A number of market conditions that could support the operations of this initiative were identified during the research effort. These include:

1. Existing Infrastructure: There are several elements currently in the market that represent a good starting point for the proposed initiative. Third party programs have focused on HVAC system airflow and refrigerant using advanced diagnostic systems. Utility training programs have been developed to train HVAC contractors in improved installation and service procedures. Finally, some of the progressive HVAC contractors in California are working towards advanced procedures that insure optimal system performance. This existing environment should be beneficial in nurturing the proposed initiative.

2. Public Awareness: The 2001 energy crisis was effective at raising peak demand as an important issue. The Governor has also made this issue a centerpiece of his position on energy. With air conditioning a key component in statewide peak demand, this intervention has a high visibility in the public eye.

3. Energy prices: Rising energy prices will help drive consumers towards energy efficiency improvements, including whole building testing and remediation.

Legislation or Policy Considerations that can Influence the Success of the Initiative

- Legislation mandating diagnostic based equipment tune-ups and installation procedures would be beneficial to California consumers, as well as the state's energy situation. The life cycle economics of a properly installed and commissioned HVAC system is significantly lower than industry standard

installation practice. Legislation could require performance standards for equipment replacements and tune-ups at time-of-sale.

- State funding earmarked for community college or vocational school programs in HVAC technology would help to supply a trained work force for the industry.

Potential for the Initiative to Achieve Market Penetration or Participation

This initiative has the potential to achieve significant market penetration because of strong public awareness on the relationship between residential air conditioning and peak demand. There is a significant effort in California government to address peak demand issues in an effort to avoid a repeat of the 2001 energy crisis. Under this backdrop, a well-designed program implementation strategy can build on existing awareness to create a strong demand for the services described in this initiative. With an appropriate incentive structure and an adequate quality control effort, this initiative should significantly impact residential air conditioner performance. With such a broad based market, it is important to implement the program in stages to insure the program flaws are worked out before widespread implementation is pursued.

Residential Whole Building Diagnostic Testing

Sector: Residential

Trigger Events: Major remodel, HVAC replacement, IAQ/mold problems

Intervention Type: Voluntary

Intervention Description

Whole building diagnostic testing involves the implementation of a “house as a system” approach to the evaluation and remediation of energy-related design and installation defects in homes. The “house as a system” initiative involves evaluating house performance as an integrated system as opposed to a number of unrelated parts. Climate, building materials (and the way they are assembled), occupant interaction, and mechanical equipment design and installation all affect the house “system” performance. This intervention strategy allows the practitioner to both identify flaws in construction or operation, and also to use the diagnostic tools to direct repairs correcting the flaws. A detailed diagnostic evaluation approach allows the practitioner to understand building performance issues and implement strategies that improve building comfort, safety, and energy efficiency. With a "house as a system" approach to remodeling, synergistic benefits are more likely to be realized. For example, when coupled with a HVAC retrofit, other energy efficiency improvements may contribute to reduced replacement equipment size, saving the homeowners money.

The whole building diagnostic approach represents a new way of thinking in addressing household energy issues. Instead of looking at energy problems from a piecemeal approach, a whole building assessment allows the trained practitioner to:

- Fully understand homeowner energy/comfort/health issues
- Evaluate in-situ “system” performance
- Implement appropriate remediation efforts
- Verify performance

The energy implications of whole building diagnostic testing services are important, but are generally secondary to issues of comfort, health and safety. Significant non-energy benefits provide leverage in implementing energy efficiency, since comfort, health and safety enhancements are not typically viewed from a cost effectiveness perspective.

Importance of Initiative to California's Energy Supplies

California is the most populated state in the United States with over 12 million residential housing units. Single family units account for 64 percent of the total, or about 7.5 million units. About 5.6 million of these homes were built prior to 1982 and were not subject to stringent energy efficiency standards currently in place. In many of these older houses, the whole building diagnostic initiative offers the potential for significant energy and demand savings. Due to the diagnostic elements and the comprehensive nature of the whole building approach, it will necessarily be a more costly approach than typical efforts focusing on a single energy efficiency measure. The higher cost of the whole building approach effectively filters the potential candidates to the "above average" energy users leading to higher energy, and possibly, demand savings. The whole house intervention strategy could potentially be tailored to target sub-regions where peak demand is straining the local transmission and distribution system infrastructure, in situations where a standard home assessment has identified problems that need to be addressed through a more rigorous approach, or when benchmarking efforts have identified homes with higher than normal energy consumption, especially when high consumption can be tied to appliance saturation data that suggests an energy related problem may exist.

Coordination With Other Interventions

Whole building diagnostic testing is a potentially important intervention that needs the support of other initiatives to achieve its full potential. Specific initiatives include:

Information to all. Educating consumers is essential in generating a market for this service. For most households there is a significant disconnect between how their household is operated and their monthly energy bill. Most energy use is invisible to the homeowner with no visible metric, such as miles per gallon, for gauging how efficient their building envelope or HVAC system is. Educating consumers about where their energy dollars go is vital in forming the basis for intelligent decision making. Utility bill analysis is an example of valuable information since it is based on customer consumption and comes from a respected source.

Branding. Branding has the potential for being an effective means for promoting whole building diagnostic testing. Whole house diagnostic-based remediation completed by a certified contractor can be tied to a visible existing brand such as Energy Star[4] or Flex-Your-Power. High consumer recognition with these brands inspires consumer confidence and could prove vital in the early stages of this intervention strategy.

Audits and Energy Ratings. Audits and energy ratings completed at the time-of-sale represent an initial screen on the potential for whole house diagnostic testing and remediation. A simple audit procedure completed at the time-of-sale could serve as a flag for pursuing more rigorous whole-building assessment procedures.

---

[4] The California Building Performance Contractor's Association was the first program in the Western United States to be recognized as fulfilling the requirements of the new "Home Performance with EnergyStar" process.

Technical Training Grants. Building the contractor infrastructure is essential in making the whole building services available in the marketplace. Technical training, such as the California Building Performance Contractors Association, is absolutely necessary in promoting this intervention. A strong field-training component is needed to complement classroom training. If this intervention is to be pushed through additional initiatives and coordination efforts there will be a need to train professionals that have whole-building assessment skills.

Demonstrations and Case Studies. Case studies of successful whole house interventions would be an effective means for conveying the benefits of this intervention strategy. Local media as well as utility bill supplements could take this abstract concept and transform it into something tangible that the customer can relate to. The case studies and demonstrations will need to be promoted and coordinated with related events, such as home shows, parade of homes displays, etc.

Organizations, Associations, and Stakeholders Affected by the Initiative

A range of actors are involved in the residential buildings sector, some of whom , own, occupy and manage dwellings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literatures concerning residential energy use and consumer behavior, the following key groups have been identified in the area of whole building diagnostic testing.

ASSOCIATIONS – There is one statewide association of whole building diagnosis and retrofit contractors. There are several HVAC contracting, design and building science groups at the state and national levels that are cognizant of and interested in promoting systematic whole building analysis.

CONTRACTORS – There is currently a small number of trained contractors and technicians in California who are involved in whole house testing and retrofit activities. A few are large integrated firms, where marketing, testing, HVAC installation, shell improvements, and other building upgrade services are performed by a single contracting organization. Other whole building contractors specialize in HVAC, remodeling, insulation, etc., bringing in other specialists as the jobs require. Several general contractors manage retrofits entirely through specialty subcontractors following the initial testing. A few energy raters also do whole building testing and refer their clients to general and specialty contractors to perform recommended retrofit work. A larger number of contractors have been trained than are currently performing whole building services in California. It is likely that their training has also had a beneficial effect on the quality of the customary services they provide (e.g., HVAC, insulation, remodeling) and on their referrals to other specialty contractors who can help to remedy significant building system problems related to health, safety, comfort, and energy efficiency.

CONSUMERS – Interest in whole house testing services seems to result from homeowner concerns about health, equipment performance, safety concerns, and interest in energy savings (the latter rarely is the first mention by consumers and most often in combination with other motivations). Many who have purchased the service report high levels of satisfaction and there is evidence of significant homeowner investments in retrofits as a result of testing.

NEWS MEDIA – In some cases, newspapers and television newscasts have covered local whole house diagnostics programs, reporting on dramatic improvements in indoor air quality, occupant health, homeowner satisfaction, and energy savings associated with retrofits.

TRAINERS – Fairly extensive training is required to learn building science basics, testing procedures, the proper use of test equipment, whole building analysis, retrofit recommendations, and quality installation techniques. There are few sources of whole building diagnosis and retrofit training, and only a small number of qualified trainers currently practicing in California.

In California, the California Building Performance Contractors Association (CBPCA) was developed in 2001 to promote the whole house diagnostic testing approach in residential construction. The CBPCA provides low cost training to interested contractors. Training includes four days of classroom activities (whole house principles, use of diagnostic tools, and software training) and two days of field training. Follow-up training in business model development and marketing is also available, as well continuing field mentoring as the contractor begins to implement the whole building approach in the field. The program marketing effort also benefits from use of the Energy Star brand and labeling. The Home Performance with Energy Star model allows the homeowner to have a single point of contact for testing, recommendation, and implementation of measures. To date, the CBPCA has trained roughly 100 contractors.

Affordable Comfort is another organization dedicated to improving the knowledge and capabilities of building contractors throughout the U.S. Affordable Comfort holds several regional conferences a year providing both classroom and field training. Both of these organizations could be expanded to handle a greater number of contractors.

Realtors and local building officials would need to become better educated on this intervention strategy if it achieves or is to achieve significant market share. Improved realtor training in basic energy efficiency would provide them the skills to assist homeowners in evaluating the merits of whole house diagnostic testing, as well as assisting them with the potential time-of-sale audit or energy inspection intervention.

The insurance industry should be favorably affected by increased use of whole building diagnostics and remediation. With mold and indoor air quality problems becoming an increasing problem, the insurance industry should value customers who have not only improved the durability and energy characteristics of their home, but also improved the indoor environment.

The market actor network diagram for this initiative is shown in Figure 6 below:

Figure 6. Market Actor Network Diagram for Whole Building Diagnostic Testing

Market Conditions that will Affect the Success of the Initiative

There are a number of market conditions that will affect the success of this initiative. These include:

1. Increasing Homeowner health and safety concerns. Homeowner health and safety concerns represent a significant market force that will affect the implementation rate for this initiative. Indoor air quality and mold problems are a major driving force in the remodeling market in California. The whole building initiative is geared towards addressing these problems and verifying the effectiveness of the remediation effort. Non-energy benefits such as improved indoor environmental conditions and lower green house gas emissions may likely be the dominant driving force for this intervention strategy.

2. Energy Prices. Energy price trends and the implementation of time of use electric rates are two market factors that could help drive the whole building intervention. In a similar manner to SUV sales falling with rising gas prices, rising gas and electric costs will create a larger financial incentive to implement energy efficiency options.

3. Available information. Information provided by local media and other sources is an important factor in promoting new approaches to energy efficiency. Demonstration project results should be disseminated to the public. Since whole building efforts typically involve fairly standard solutions to building performance problems (from the viewpoint of materials), homeowners may be attracted to the simplicity of the approach.

Key Barriers Associated with the Success of the Initiative

There are several barriers that could reduce the effectiveness of a whole building diagnostic testing intervention strategy. These include:

1. <u>Lack of expert advice and information</u>: Without better education of the residential customer as to how energy is consumed in the home, this initiative will

likely flounder. This initiative is closely tied to the “Information to All” intervention since only an educated homeowner can make an informed decision on the potential benefits of the whole building diagnostic testing strategy.

2. Lack of trained and certified contractors. Although there is a mechanism in place to train contractors, significant statewide demand for services does not currently exist. Without the demand from the marketplace, it is difficult for a contractor to justify the expense of having their employees go through the training and purchasing the diagnostic equipment. This barrier is closely linked to barrier #1 above.

3. Inertia. In boom cycles, contractors have little motivation to differentiate themselves from their competitors since work is abundant. Changing a contractor’s business model from the status quo to a performance-based approach has an element of risk. Each contractor needs to determine the costs and benefits of undergoing this transformation.

4. Lack of valuing non-energy benefits. Much of the benefit of whole house diagnostic services in an improvement in indoor comfort, indoor air quality, health and safety, and overall aesthetic improvements to the structure. These benefits are very real to the homeowner and typically of more significance than the potential energy savings. Unfortunately CPUC Total Resource Cost test methodologies do not value the non-energy benefits.

5. Lack of valuing performance verification. Utility programs offering incentives to homeowners for installation of energy efficiency measures do not regularly verify that the installed measure performance is consistent with the design intent. The whole building approach involves performance verification resulting in documented value to both the homeowner and the utility.

6. First cost. Cost is certainly a barrier to this approach. With the comprehensive nature of this approach and the expense associated with the diagnostic testing, whole building remediation may only be cost effective to customers who posses three key characteristics: above average energy use, high valuation of non-energy benefits, and disposable income to pursue the remediation effort. Likewise, the first cost of making whole house retrofits can be prohibitive for many families.

Strategies for Overcoming these Barriers

The barriers to transforming the whole building diagnostic testing initiative to a mature industry are significant. Key barriers and strategies for overcoming the barriers are listed below:

Developing a market. A primary barrier that needs to be addressed is the push-pull dynamic between homeowners and contractors. If homeowners do not see value in this initiative, contractors will not have motivation to differentiate themselves from their competition to provide the services. The broad marketplace needs to be educated on the comprehensive benefits whole house diagnostic testing and remediation offers. Case studies documenting remediation efforts on homes with significant problems (health and safety, energy, and comfort) must be disseminated

through various media forms. The “Information to All Homeowners” intervention is therefore critically important to jump-start the marketplace. Utilities and the state can take the lead in this effort. Once the market has created demand, training efforts can grow to supply certified professionals to meet the demand.

From the customer perspective, the whole building diagnostic initiative offers the potential for an improved remediation process. In dealing with a single, certified contractor, the homeowner will experience a streamlined process from design through verification. Instead of dealing with multiple subcontractors who have little or no knowledge of each other’s work or responsibilities, this integrated approach should result in an improved environment. Since the certified contractor has adopted a holistic approach to the home and its occupants, the interaction between contractor and client should benefit.

Valuing non-energy benefits. Existing utility and third party programs must also recognize the documented benefits this intervention provides. Unlike other measures, which may or may not have limited field verification, this intervention will have documented performance improvement. Program incentives must recognize the enhanced value of such an approach and also potentially add value based on non-energy benefits.

Program Development. Develop utility or third party programs with enhanced incentives for this intervention strategy. Verified performance improvements and the comprehensive benefits offered by this strategy need to be recognized and valued.

Insurance Industry initiative. Work with the insurance industry to recognize the mutual benefits of this intervention strategy. Valuing of the benefits should result in preferred insurance premiums for these customers. A before and after case study of a sample of homes might make a convincing argument for such an approach.

These efforts will substantially reduce the barriers identified above and if effectively implemented will allow the initiative to succeed and grow in its impacts.

Market Conditions that Support the Initiative

A number of market conditions that could support the operations of this initiative were identified during the research effort. These include:

1. Valuing of non-energy benefits: Both homeowners and the insurance industry are becoming increasingly aware of, and concerned about issues that compromise occupant health and safety. This market concern could play a significant role in spurring this initiative.

2. Energy prices: Rising energy prices will help drive consumers towards energy efficiency improvements, including whole building testing and remediation.

3. Lost opportunities: The CPUC’s increased emphasis on energy efficiency programs capturing all available savings in a particular building could lead to more whole building diagnostic testing.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Legislation could be pursued directing the insurance industry to categorize homes differently that have undergone whole building diagnostic testing and remediation. This recognition could be similar to an Energy Star rated home, but instead focus on the whole house, not just the appliance mix. This rating could be an Environmental Star home, or some other easily recognizable term. A healthier indoor environment should demonstrate a lower incidence of associated with lower occupational risks. Additionally, the CPUC should modify the TRC methodology to account for non-energy benefits associated with this initiative.

Potential for the Initiative to Achieve Market Penetration or Participation

This initiative requires support to first, develop the market and, second, develop the trained infrastructure to service the market. With these key elements in place, market penetration should slowly increase. Other factors could serve as a catalyst to increase the customer participation rate.

Low Income Multifamily Housing

Sector: Residential

Trigger event: Building sale, refinance or lease, property rehabilitation

Intervention type: Mandatory and Voluntary components

Intervention Description

This intervention covers a series of strategies intended to improve the energy efficiency and affordability of existing low income multifamily housing in California. The interventions will attempt to work within the labyrinth of existing policies, procedures and agencies to the maximum extent possible. Typically a multifamily housing developer applies to the California Department of Housing and Community Development (HCD), the California Tax Credit Allocation Committee (CTCAC), the California Housing and Finance Association (Cal HFA), probably a local funding source, a private bank, and possibly other sources for project financing. Resources for affordable housing developers include the tax-exempt bonds of which Cal HFA is one of the main providers, the CTCAC, and the multifamily housing program that is administered by HCD. Nearly every type of affordable housing goes through one if not multiple agencies. In almost all cases developers use both the tax-exempt bonds from the California Debt Limit Allocation Committee (CDLAC) and the tax credit financing to preserve the project as affordable. In affordable housing projects, tax credits are probably involved in close to 80 percent of the projects.

The following elements are envisioned for a coordinated strategy for low-income multifamily housing:

- Benchmarking. Introduce benchmarking to the property managers and train them on how to use a benchmarking system. Through the benchmarking system, real-time information on how their properties operate, where the biggest energy users are, and how the energy use of one property compares to another property can be determined. The benchmarking system also serves as a portal to the energy efficiency program funding available for multifamily and low-income properties.
- Subsidized housing tax regulatory process is key lever. Developers that participate in subsidized housing programs generally receive tax credits and other financial incentives for their investments in low-income housing. Energy ratings and energy efficiency upgrades should be required as a condition of participation in these programs. It does not make sense for California to be subsidizing lower efficiency construction practices when better practices are cost effectively available that help lower tenant costs.
- Property rehabilitation is key trigger event. Housing rehabilitation projects provide an important opportunity for improving energy efficiency. The projects are generally invasive to the point where tenants are relocated during renovation,

providing the opportunity to upgrade major building systems such as windows, shell insulation, common area lighting, HVAC and water heating. At this trigger point, diagnostics and measure verification can be completed done quickly and efficiently, reducing “per unit” costs. Again, California should not subsidize rehabilitations that are not at least Energy Star equivalent.

- Target preservation projects. Preservation projects, e.g. those where the rehabilitation project preserves the affordability of the housing will be targeted. Many of these projects go through Cal HFA refinancing under HUD section 8, or in conjunction with other HUD-based financing. The California housing partnership program works on preservation project restructuring. A list of preservation projects that are most likely to be experiencing major re-capitalization as part of a buyout of an original investor should be targeted.
- Use state agencies as hubs for efficiency information, training and funding. State agencies in their roles as arbiters of energy efficiency information should be targeted in this initiative. State housing agencies can be used to educate developers about efficiency issues and can get efficiency program and rebate information to developers. Create linkages between the Cal HFA, CDLAC, and CTCAC funds, and the available funds for energy upgrades. Access efficiency funding potential as part of the standard application process for other funding sources.
- Energy ratings: Develop incentive programs that provide funding for conducting energy ratings and whole-building energy audits. A energy-efficient pricing scheme for multi-unit developments should be created to capture savings. initiative services should include filling out the program participation forms for a developer, arranging for a rating, arranging for an energy consultant as necessary, and advising the developer on equipment choices. Incentive payments should be fast and focus on cost effective measures and whole-building performance. Use existing state funding sources or public goods charge funding to cover the cost of the rating and audits. Cal HFA has a predevelopment loan program, which covers both pre-construction and/or pre-acquisition expenditures. Make energy ratings and audits an eligible cost under this program; or make the audits cost a reimbursable item for successful projects. When a loan is closed with Cal HFA the costs can be folded into the financing package without requiring a separate application for predevelopment. Require energy ratings as a condition for receiving the energy efficiency funding.
- Utility Allowances. The impact of additional costs for energy efficiency can be mitigated under the tax credit program by encouraging the use of utility allowances that properly reflect the distinctive consumption characteristics of the energy efficiency project. Efforts to establish energy efficiency utility allowances should be encouraged by state agencies and should be undertaken as part of a broader strategy.

Importance of Initiative to California's Energy Supplies

Multifamily apartments and condominiums represent 31 percent of the total housing stock in California, with 83 percent of these units occupied by renters. About 56 percent of multifamily occupants earn less than $35,000 per year, making about 17 percent of the total units in the state low income multifamily. The combination of having units occupied by low income tenants and the split incentive nature of energy efficiency make this group especially hard to reach.

Coordinating This Initiative with Other Interventions or Activities

Activities promoted through this intervention need to work closely with other interventions considered in this report:

Benchmarking. The benchmarking initiative can provide the comparative energy consumption information and utility bill tracking for multiple properties under management by a single agency or non-profit organization.

Whole Building Diagnostic Testing. Once the decision has been made to improve the efficiency of the building, a contractor can be hired to make the upgrades. Upgrades made from a whole-building perspective will likely result in greater energy savings along with other non-energy-related benefits such as improved comfort and a healthier indoor environment.

Demand response. Efficiency upgrades will likely affect the peak demand of the building. The option of a demand responsive rate structure should be presented to the building owner. Retrofits undertaken to improve efficiency and reduce peak demand, linked with a demand response rate can make the retrofits less expensive over the long run. Metering costs for master-metered properties may be lower for multi-family properties on a per unit basis.

Information Training and Education. Training of property managers, asset managers, non-profit organizations and housing developers on energy efficiency options is needed. This initiative should coordinate with advertising and marketing campaigns designed that are designed to increase the awareness of multi-family options.

Coordination. Since this is an "information only" intervention, coordination with applicable incentive and direct installation programs offered by the utilities and others will be critical.

Tune-ups and O&M. Tune-ups and O&M are an important service that will be promoted by the information offered through this intervention. Multifamily projects offer the potential for significantly reduced implementation costs relative to single family, especially if the property is being rehabilitated.

Organizations, Associations, and Stakeholders Affected by Initiative

STATE HOUSING AGENCIES These agencies include the California Housing and Finance Association (Cal HFA) – a provider of tax exempt bonds for affordable housing developments; California Tax Credit Allocation Committee (CTCAC); California Debt Limit Allocation Committee (CDLAC); California Housing and Community Development (HCD). For the most part non-profits look to the state housing agencies for construction or rehabilitation-related information. Multi-family owners and construction contractors do not typically rely on information from the CPUC, the Energy Commission or the IOUs.

HUD U.S. Department of Housing and Urban Development (HUD) is a key stakeholder in the multi-family market.

DEVELOPERS including both non-profit and for profit housing developers who build and renovate properties.

ASSET MANAGERS Many of the nonprofits have an asset manager making capital improvements and investments decisions for the properties they own.

TRADE ASSOCIATIONS Associations include: Affordable Housing Management Association (AHMA), primarily focus on section 8 projects and is made up largely of for-profits organizations and asset managers. The other major multi-family related trade associations for the nonprofits are: Nonprofit Housing Association of Northern California, San Diego Housing Federation, the Southern California Association for Nonprofit Housing, and the California Coalition for Rural Housing.

PUBLIC HOUSING STAFF Public housing staff are generally under funded and over worked. Over the past 5 years public housing authority budgets have been cut about 20 percent to 35 percent while the number of low income families in California has increased. Yet these authorities and their staff play an important role in determining what kinds of project are built and the energy efficiency of these projects. This group needs to support this initiative.

PROPERTY MANAGER Property managers are in a position to make many day-to-day decisions that affect energy efficiency of the properties they manage. These individuals may not have the skills or knowledge necessary to understand the energy implications of their decisions. Education and training programs targeted at property managers may help improve the efficiency of their properties.

Market Conditions that will Affect the Success of the Initiative

Market conditions affecting the success of the initiative include:

Energy Prices. Energy price trends and the implementation of time-of-use electric rates are two market factors that could help encourage agencies to improve the efficiency of their properties.

State of the economy. The general state of the economy is one of the factors contributing to the number of residents living in low-income housing and has a direct

bearing on the amount of property needed. The more pressure on property development, the less resources and time are available to focus on energy efficiency. However, the more units needed, the stronger the need for energy efficient units.

Capacity to provide services. The availability of trained auditors and installation contractors is a critical factor affecting how broadly this initiative can be implemented.

Key Barriers Associated with the Success of the Initiative

The key barriers associated with the success of this initiative include:

Inconsistency in funding. Funding for multi-family efficiency programs has been inconsistent over the years. Developers may avoid these sources based on prior bad experiences when there has been the promise of program initiatives and expanded efficiency options only to have those resources be spent in other sectors.

Low priority for energy projects. Project funding allocated for energy efficiency may get traded away to make the project workable from an overall financial perspective. While project funding facilitators have supported energy efficiency in the past, in many cases these desires has dissolved away when project funding is reduced or does not fully materialize. The energy efficiency measures are then cut so that the project can move forward. The choice by many of the funding facilitators has been to get the structures build and give up the efficiency measures in order to move the projects forward.

Lack of information. Developers and owners often do not know what the energy efficiency alternatives are when the need to remodel or renovate a property arises.

Difficulty in applying for funding. The process and structure for getting funding for energy efficiency upgrades may not be worth the time invested to procure that funding. Energy efficiency is generally not an important criterion for obtaining funding and developers are more interested in getting the project done.

Timing issues. Efficiency program timing may not be consistent with multi-family funding and project development timelines. Long-term programs with funding consistency and continuity are needed.

Uncertainty in policies and regulations. Housing authorities are reluctant to act without written approval from HUD. If the authority is audited and the audit finds dollars spent on energy efficiency they can be penalized if they do not have expressed written consent for the efficiency expenditures. HUD has been reluctant to provide energy efficiency approvals in writing. There may not be a strong enough commitment to energy efficiency until HUD commitment leads to an energy efficient funding stream or written project approvals.

HCD + HUD rent guidelines. Energy efficiency does not show up in net rent calculations. All HUD buildings have the same utility allowances credits per type of unit. As a result, no energy efficiency price messaging is sent back to the developer or tenant. The allowance is the same for all units.

Insufficient focus on multifamily populations. Multifamily low-income energy efficiency programs are generally less cost effective than programs serving other markets, due to the need for higher incentive levels and greater administrative support. Although current CPUC policy has considerations for hard to reach customers, the emphasis on low income multifamily housing could be greater.

Lack of financing. There is a lack of financing for improvements done between renovation events, since these projects are not tied to special financing programs for affordable housing.

Lack of property manager knowledge. Property management core competencies do not typically include expertise in planning and implementing energy efficiency projects. In particular, developing sources and use plans that tie together multiple financing resources to fund comprehensive projects, (a key activity for developing a project) is outside of the skill requirements of many property managers. Many multifamily properties stall or undergo only partial implementation after completion of an energy audit because the property manager may not have the experience or resources to develop an action plan.

Strategies for Overcoming These Barriers

Simplify rating application process. Make the energy rating a simple, over-the-counter product, where a developer sends in a request and a rater does the rest. Make energy efficiency assessments and project development a part of the standard funding application process. However, the process needs to be kept very simple to operate and not add costs or time delays to the project. Where possible, make fast-track review and approval processes available for the high efficiency structures and renovations so that the high the building's energy efficiency level the faster the project approval process. Put the highest efficiency projects at the top of the approval process.

Minimum efficiency standards. California should have a minimum standard for energy efficiency for housing that receives public support that is at least consistent with other high efficiency structures.

Develop case studies. Develop case studies to demonstrate successful energy efficient housing projects.

Education and training. Develop stakeholder training programs for the existing affordable housing market. Training for property managers on energy efficient property design, management and inspection practices should be considered. Training on inspection and maintenance protocols for HVAC equipment should also be included. Training can be developed in partnership with housing management associations and utility energy training centers

Property manager guidance manual. Develop an energy efficiency guidance manual for property managers. The Manual should be developed in partnership with HCD and housing management associations.

Financing. Financing incentives and wider access to direct install services are also an essential component to putting together financing strategies and plans for

multifamily projects. Create a multifamily financing component of the initiative within the Energy Commission using income guidelines for energy programs that are coordinated with California's financial guidelines for housing programs

Turn key services. Develop the initiative so that it can function within the established multi-family development arena. Install within this market a full-service approach so that the same people who are approving and funding projects have a direct interest in making sure the projects are efficient. Build within the established framework, but bring energy efficient to a higher level of importance. j

Legislation or Policy Considerations that can Influence the Success of the Initiative

Development of low-income multifamily projects is a process with significant involvement by local, state and federal government agencies. Administrative and legislative considerations recommended for this intervention include:

- Working with HUD to write separate utility allowance guidelines for energy efficiency projects.
- Require energy ratings and apply minimum efficiency standards to projects receiving state funding.
- Require all new projects and renovations that use public funds or publicly supported funds to be energy efficient.

Potential for the Initiative to Achieve Market Penetration or Participation

The legislative initiatives proposed here will likely have a large impact on new construction projects as well as major rehabilitation efforts that require public funds or approvals.

Potential of the Initiative to Influence Energy Savings or Demand Reduction

There are significant efficiency improvement opportunities in low-income multifamily properties. Heating systems, water heating systems, lighting, appliances, shell construction, and air conditioners are among these opportunities. Properties may lack proper maintenance of HVAC systems. Training property and asset managers on efficiency choices and providing funding or funding support for these upgrades can positively affect the efficiency of multifamily units.

Benchmarking

Sector: Commercial

Trigger event: Building sale or refinance

Intervention type: Voluntary

Intervention Description

This intervention involves the use of commercial building energy consumption benchmarking as a means to gain the attention of decision makers who can influence the energy efficiency of a building and to motivate these decision makers to implement measures that will improve energy efficiency. Benchmarking involves placing comparative energy consumption information into the nonresidential market in a form that building owners and operators can use to easily see how their buildings perform relative to other similar buildings in similar weather and use conditions. Benchmarking should be viewed as the initial step in a comprehensive efficiency upgrade program. Follow-on steps include auditing of building HVAC systems and controls, retrofit of inefficient systems with more efficient technology and retro commissioning to assure that upgrades have been made successfully.

Existing commercial building benchmarking systems include the EPA Energy Star benchmarking system and the LBNL Cal Arch California Building Energy Reference Tool. Both of these systems use a web interface and compare the energy consumption data of a particular building to a database of building consumption data for a large number of other existing similar buildings. The EPA tool uses the federal Commercial Building Energy Consumption Survey (CBECS) data, while the current CalArch tool uses data from the Commercial Building End Use Survey (CEUS) that is specific to California buildings. The CEUS data was first collected in the early 1990's and is updated periodically – a current survey is now being conducted with building data being available for use by CalArch in late 2005. Development of the CalArch tool was funded by the Energy Commission's PIER program.

In its simplest form benchmarking compares energy consumption per square foot of floor space for comparable classes of buildings or Standard Industrial Code (SIC) designations. To calculate a "first level" benchmark requires a very limited set of information that should be readily available without requiring energy audits of the building. This first level benchmark is useful for identifying the worst performing buildings for targeted attention. However, there are many variables that determine the relative energy performance of buildings, and by considering more detailed information about a building and comparison information for buildings in a benchmarking database, more insightful comparisons can be made. Obtaining this more detailed information requires onsite investigation, which is time consuming and may be difficult to accomplish for all buildings. To address this issue, the benchmarking tool should be designed to have multiple levels of increasing detail so that both the simplest benchmarking and potentially more meaningful comparisons could be done by drilling down into building details or identifying specific end uses.

Benchmarking buildings in terms of a total energy consumption metric combines the impact of how the building(s) is (are) operated and what energy efficiency features are present. It is difficult to separate equipment/facility efficiency from the operational issues without additional building descriptive information. To address these possible differences a comparison of the energy consumption of the building to a minimally

Title 24 compliant version of the same building under as operated conditions should isolate efficiency issues from operations issues. Although a substantial amount of information is needed regarding the features of the building to make this comparison, this is one of the more detailed levels of comparison envisioned.

The overall elements of the benchmarking intervention are as follows:

1. Financing or refinancing should be important as a trigger event. Building financing and refinancing are proposed as key trigger events at which benchmarking will occur. Financing/refinancing occurs periodically throughout the life of a building, starting at time-of-sale and is a time when it is appropriate to consider the operating costs of the building and ways those operating costs can be reduced. Other trigger events may include benchmarking the building as a condition for leasing of space within the building (see the commercial building leasing intervention). Benchmarking is required as a condition for recognition under the EPA Energy Star and LEED Existing Building rating programs.

2. Benchmarking could be accomplished by utilities in conjunction with utility bills. This element requires utilities to benchmark all buildings. This benchmarking would logically occur as part of the utilities' function to provide energy bills. Benchmarking would provide additional information that would allow owners of buildings to compare their building's energy use to similar buildings in the general population as well as comparing the energy consumption of a group of buildings under the same management. This would require the utility to collect enough information about building characteristics (both equipment and usage) to permit these comparisons to be accurately made. A mechanism should be provided for continuous updating of benchmarking scores with each billing cycle to track the effectiveness/impact of changes in building operations or installation of energy efficiency features. Benchmarking also provides a means for utilities to target poorly performing buildings energy audits. Energy efficiency marketing information will also be provided in conjunction with benchmarking to communicate the benefits of further investigation/action and to inform building owners about incentives and services they can obtain from the utilities and other sources.

3. Referrals to energy audit programs and to retrofit improvement programs. Benchmarking alone leads to only limited energy savings (perhaps to a change in operating practice based on a consciousness that consumption can be lower). Also, benchmarking can be misleading – if a building scores in what is viewed as a satisfactory range, the building owner or manager can be discouraged from looking deeper and substantial potentially cost effective actions may not be pursued. To motivate further investigation into what may be cost effective for the individual building, referrals to energy audit programs should be made. This would be followed by appropriate actions to address the problems and opportunities found in the audit. Retro-commissioning should then be undertaken to assure that the upgrades have been successfully accomplished. Benchmarking is viewed as the first step in a process of further investigation and action. Employing auditors, contractors and commissioning agents should direct owners to a comprehensive solution to improve their benchmarking score.

4. Energy Efficiency Marketing Information. With benchmarking, the user of the benchmarking tool would be provided with effective marketing information to encourage further investigation and action to achieve energy efficiency in the building. This information would include information regarding the likely benefits of particular measures, avenues to further investigation/action, and identification of additional sources of incentives or information regarding specific actions. The provision of this information is an integral part of an overall benchmarking program.

5. Periodic Benchmarking. The benchmarking tool will be designed to encourage repeated uses of the tool to track the progress of improvement in the energy efficiency of the building. The benchmarking tool will be designed to facilitate and guide this periodic benchmarking based on updated information about the building's energy consumption, operating practices and energy efficiency features.

Importance of Initiative to California's Energy Supplies

This is a major initiative serving as the entry point for other interventions studied under this project for commercial buildings. While providing limited direct energy savings by itself, referrals to retro-commissioning, audits and existing incentive programs should have a major impact on the efficiency of commercial buildings by increasing participation rates in those programs.

Coordinating This Initiative with Other Interventions or Activities

This intervention should be coordinated with the following interventions and activities:

Retro-commissioning Retro-commissioning is seen as one of the primary interventions directed from the benchmarking system.

Commercial audit programs. Audits, like retro-commissioning, will be directed from the benchmarking system.

Leasing. Energy efficient leasing arrangements may include a clause that requires benchmarking the building.

Information, Case Studies and Demonstrations This intervention needs to be integrated into the Benchmarking initiative to satisfy the information needs of all relevant market actors.

Multifamily Low Income. Benchmarking of multifamily properties and comparison of a set of buildings within an agency portfolio is a component of the multifamily intervention.

Green Building Initiative (GBI). Benchmarking is a key provision of the Green Building Initiative, authorized by Executive Order S 20-14. Plans for benchmarking under this initiative should be coordinated with those planned under the GBI.

U.S. EPA Energy Star. Work on benchmarking systems for California should be done with the cooperation (and co-branding) of the EPA Energy Star system.

Organizations, Associations, and Stakeholders Affected by Initiative

A range of individuals are involved in the commercial buildings sector, some of whom actively manage buildings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literatures concerning commercial buildings and general supply chain dynamics, the following key groups have been identified in the area of commercial building benchmarking.

BUILDING OWNER – Commercial buildings are owned and operated through a wide variety of arrangements. Small buildings may be owned and managed by a sole owner. Management may be done by a specialized firm for a portfolio of buildings having different owners. The very largest owners tend to be real estate investment trusts (REITs), pension funds, and insurance companies, although there are some notable large private commercial real estate owners.

Arrangements for maintenance, improvement and operation of the physical properties is also highly varied. These range from no on-site presence (with HVAC contractors and other trades called in when a tenant reports a system failure), to large staffs on and off-site that may include building operators, technicians, licensed engineers and energy specialists.

For most building owner/operations types, however, there seems to be a lack of objective and credible ways to assess the energy performance of their buildings. As one observer noted, owners who are informed by contractors or energy services companies (ESCOs) of efficiency potentials quite reasonably ask “Is what they’re telling me real?”

INVESTORS – In publicly traded companies and pension funds, ownership is diffuse, but not necessarily irrelevant to the problem of building energy performance. Observers noted that investors can have real leverage over decisions, whether these investor are large stockholders, or the analysts that write the reports that the stockholders use in making decisions.

LENDERS – In cases where borrowed capital is used to finance building purchase or renovation, lenders review the detailed return on investment (ROI) calculations, including energy cost estimates and plans for the allocation of those costs.

MANUFACTURERS – Provide equipment for space conditioning, lighting, controls, and production processes for use in new and renovated commercial buildings. Performance claims for equipment and systems are made and competitive advantage is sought.

AUDITORS – Act to identify ways to improve benchmarking results

CONTRACTORS – Incorporate retrofits to address issues identified in the audit

COMMISSIONING AGENTS- Assess the building situation after retrofits to determine whether upgrades have been made successfully

NON-PROFITS / NGOs – Organizations that promote energy conservation, green buildings, green house gas reduction, and "social choice" and "environmentally preferable" investing, focus attention on both high-performing and poorly-performing firms, including the use of energy in their buildings. The also contribute to overall environmental awareness and demands from customers, clients and employees.

STATE OF CALIFORNIA – Supports research and development on benchmarking and commercial buildings technologies that have improved energy performance characteristics, e.g., through the Energy Commission Public Interest Energy Research (PIER) program. Plays a role as objective third party actor that, as one observer put it, can "package things up and weed through the claims. Government folks are the objective credible screen on all of this."

U.S. EPA/DOE – Operates a building benchmarking system through the Energy Star commercial buildings program.

UTILITIES – Have multiple points of interaction with building owners and operators, through account representatives, efficiency programs, and high level executive contacts. Although, as businesses, the motives of utilities are often closely examined by customers, they are also a familiar source of financial incentives for efficiency improvement.

The market actor network diagram for this initiative is shown in Figure 7 below:

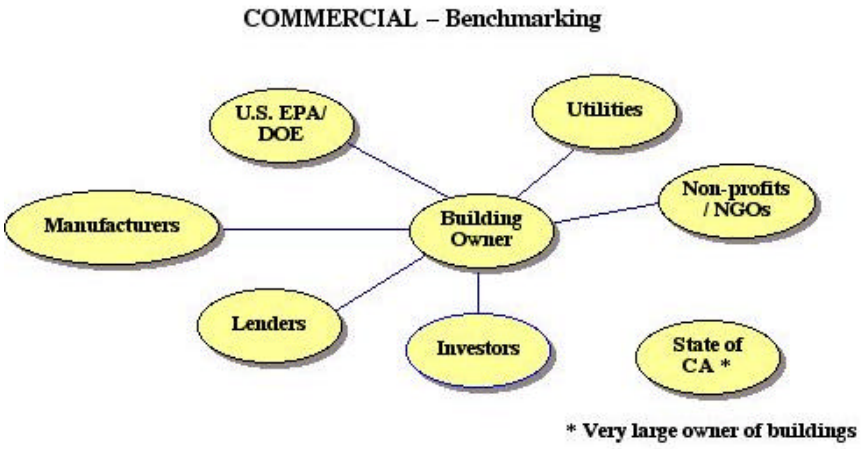


Figure 7. Market Actor Network Diagram for Commercial Benchmarking

Market Conditions that will Affect the Success of the Initiative

Benchmarking is a key element of the Green Building Initiative and the Energy Commission PIER programs. Given this level of support, benchmarking will likely be implemented within California. The nature of the benchmarking program interface with the customer and the links to other programs under the GBI initiative have not been established.

The commercial building leasing market can have an effect on benchmarking. In a "buyers/renters" market tenants will look to buildings that are comfortable and energy efficient. Benchmarking and the logical implementation steps previously outlined can uncover issues that should provide these qualities and result in a better, more rentable building.

Key Barriers Associated with the Success of the Initiative

The key barriers associated with the success of this initiative include:

Lack of awareness of relative building performance. Building owners and managers may not have any idea on how well their building is performing from an energy consumption standpoint. Without some awareness of whether or not the building is a good performer there may not be much incentive to take action.

Lack of detail in billing information. Billing data may show a comparison of the energy consumption from one year to the next, but does not tell the customer if the building is efficient.

Information alone does not spur action. Even with an awareness of the relative energy performance of a building, many owners and managers do not have much of an idea about what to do next. A lack of information about efficiency options and their benefits is a barrier

Lack of organizational commitment to energy management. Energy benchmarking data along with programs to improve efficiency may not spur action within organizations for which energy efficiency is not an important consideration. The best possible programs need an organizational commitment to be effective.

Lack of a standard metric for comparison. The CalArch and EPA Energy Star tools use different metrics of comparison. The EPA has a simple numerical score, while the Cal Arch tool places buildings within a range of comparison (upper quartile, low quartile etc.) The EPA scoring algorithms also change over time. This lack of consistency may cause confusion in the marketplace.

Non-uniformity in benchmark definition. Benchmarking is a generic term that has been implemented in different ways by the different tools available in the marketplace. This is also a source of confusion in the marketplace.

Mismatch between person receiving the bill and the decision maker. Benchmarking data delivered through the paper utility bill may not be seen by the appropriate decision maker, since these are generally sent to the accounting department for payment and are not seen by the building manager or owner. Even if the billing data reaches a knowledgeable person, a poor benchmarking score may be hidden from upper management by the energy manager.

Utility investment in paper billing systems. Utilities have a large investment in current paper billing systems. Any changes to billing format or content will need to overcome institutional momentum.

Lack of building characteristics data in utility customer information systems. For benchmarking scores to be meaningful, some customer specific data such as

building type, operating hours, square footage, and businesses type is necessary. These data, when they exist, may not be updated.

Need for follow on. Benchmarking and energy consumption tracking are ongoing activities requiring ongoing attention by the customer or a service provider. Resources should be provided to make this practice business as usual. The buildings should be benchmarked periodically, at least semi-annually. The initial benchmarking analysis will likely need some involvement from the building owner or manager to get the process started.

Lack of reasonable comparison group. Certain unique building types may have no peers in the comparison group. Benchmarking of these buildings against other similar buildings may not be possible.

Time required to see response after taking action. Once a building undergoes an upgrade, it may take some time for the results of the upgrade to be evident in the utility bills. This may frustrate customers who want more immediate feed back after they make an investment in building improvements.

Brand recognition and momentum of Energy Star. The Energy Star brand and the current Energy Star benchmarking system has significant recognition and momentum in the market. California buildings score fairly well in the Energy Star system compared to buildings around the country. Property owners and managers that currently use Energy Star to market their properties may resist attempts to make a more stringent California benchmarking tool.

Program funding constraints. Utilities are currently funding efficiency programs out of PGC and resource procurement funds. If the utilities are required to implement benchmarking on a large scale without additional resources this will shift funds away from existing programs.

Strategies for Overcoming These Barriers

Progress tracking. The executive order issued by the governor's office requires efficiency improvements in state buildings. Benchmarking of existing state buildings can serve as a means to track progress in meeting this order. Beyond buildings that house state government functions, several state pension funds such as CALSTERS own significant real estate investment property. A state directive to begin to benchmark these buildings and track consumption could bring a significant number of buildings into the system.

Goal Setting. Beyond the executive order covering state buildings, other organizations or municipalities may create similar goals for improving energy efficiency. As these organizations make these commitments, baselining can be an effective way to track progress against these goals.

Program participation requirement. Utility efficiency programs provide incentives for energy improvements at various points along the lifetime of a building. As these improvements are made, benchmarking and tracking of utility bills within the system could be a requirement of program participation.

Work with Energy Star to improve tool for California, or co brand a California specific tool. Energy Star is a powerful brand with recognition and a track record in California. Creating a new benchmarking system and brand could be counterproductive. A California tool should be created in cooperation with the EPA and use the Energy Star name if possible.

Link to best practices. Work with the Building Owners and Managers Association (BOMA) and the International Facilities Management Association (IFMA) to get benchmarking listed as a best practice for building property management. Enlisting these powerful trade organizations can be very helpful in promoting the benchmarking concept.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Executive Order S 20-14 directs the Energy Commission to develop a benchmarking system for all commercial and public buildings in California. Further policy requirements to state agencies on implementing the system may be necessary to insure that the system is used.

Potential for the Initiative to Achieve Market Penetration or Participation

Executive order S 20-14 provides assurance that a system will be developed and deployed. The details of the system have not yet been established. Use of the system at this point is voluntary, and may require marketing and promotion to achieve wide acceptance.

Potential of the Initiative to Influence Energy Savings or Demand Reduction

Benchmarking by itself is not expected to save significant energy, but actions taken in response to the benchmarking score have great potential. The executive order also directs the Energy Commission to implement Retro-commissioning programs, which are seen as an important referral from the benchmarking system. The energy and demand savings potential resulting from retro-commissioning programs is very strong.

Retro-commissioning and O&M

Sector: Commercial

Trigger event: Benchmarking referral, change of ownership, change of lease, remodeling, equipment replacement, capital budgeting.

Intervention type: Voluntary

Intervention Description

This initiative focus on services that can be offered in the market to correct faults in building systems operations and helps keep systems operating at their peak efficiency. The objective of this initiative is to place retro-commissioning services as well as tune-up and operations and maintenance (O&M) services into the market at key trigger points and on an ongoing basis to maintain building system performance and reduce energy consumption. Likewise individual equipment assessments that emphasize planned cost effective replacements over "replace on failure" strategies may offer advantages for California's energy markets especially if these initiatives are coordinated with applicable rebate programs.

The Retro-commissioning process is recognized as one of the most cost effective strategies available for improving the efficiency of existing commercial buildings. Retro-commissioning programs are often seen in the context of an ongoing or periodic relationship with a customer rather than a one-time short-term interaction. Generally, the retro-commissioning process as envisioned in this Intervention consists of activities that flow naturally from benchmarking and energy audits that result primarily in low cost upgrades to building operations and control strategies and replacement of failed components. Subsequent steps may involve larger capital improvements and equipment replacement, some of which may qualify for efficiency program rebates. Ultimately, this may lead to retrofits of the building lighting and envelope along with HVAC improvements. O&M is certainly an ongoing process. Maintenance ensures equipment is capable of delivering savings; operations makes sure savings are delivered once maintenance is done. Retro-commissioning itself is the existing building corollary to commissioning for new buildings. Retro-commissioning involves assessing existing building performance and equipment, often after a major remodel or retrofit or operational enhancement, The efforts herein stress low-cost operational upgrades as the area where the most cost effective improvements can be made. This however does not mean that equipment upgrades should be ignored once the most cost effective operational measures have been implemented. Elements of a retro-commissioning intervention should include:

<u>Case studies relevant to commercial building business environment</u>. The commissioning literature contains case studies that document the costs and benefits of building commissioning. Most of this literature studies commissioning of government or institutional buildings. Commercial building owners and property managers operate in an environment that is much different from the government or institutional environment. Case studies about commissioning in a commercial building context should be developed that are relevant to commercial building decision makers.

<u>Develop infrastructure to provide commissioning services</u>. Developing infrastructure is an important requirement for any commissioning intervention. There are currently relatively few high level commissioning service providers. Developing the skills and expertise of commissioning service providers is a key element.

<u>Create demand through incentives and/or tax credits</u>. Although the energy savings potential for commissioning is strong, the market demand for these services is weak.

Building managers and occupants for the most part get along fine working in poorly-performing buildings and do not see the need for the service. Financial incentives in the form of rebates or tax credits may be needed to stimulate interest in the market.

Investigate risk issues and highlight case studies in the context of risk management. Risk management is an important operating principle for many companies. Casting commissioning as a risk management tool rather than strictly an energy savings tool may provide traction for the service in the commercial building owner and manager community. Retro-commissioning of buildings helps control risk from volatile energy costs as well as loss of tenants due to comfort issues and risks of litigation stemming from indoor air quality problems.

Screen customers for retro-commissioning potential. Not every customer is a good prospect for retro-commissioning; the buildings must have a good combination of technical potential and a management structure that is willing to examine the issue and make decisions. Very old buildings with systems that are near the end of their service life may not make good candidates for operational upgrades. It may not be worth spending money fixing a system that will need to be replaced soon. In that case it might be worth considering equipment system upgrades as part of the building improvement program.

Importance of Initiative to California's Energy Supplies

A recent meta-analysis of the costs and benefits of commissioning new buildings and retro-commissioning existing buildings concluded that retro-commissioning may offer greater energy savings at lower costs than traditional hardware programs (Mills, et al., 2004). Energy savings averaged 15 percent of the whole building consumption, with demand savings on the order of 0.6 W/ft^2. Documented non-energy benefits covered about two-thirds of the cost of the service. Retro-commissioning is seen as a key strategy for producing energy and demand savings in commercial buildings.

Coordinating This Initiative with Other Interventions or Activities

This initiative will need to be coordinated with the following interventions and activities:

Benchmarking. Benchmarking is seen as the "portal" for commercial building owners to access information about the performance of their building and services such as audits, retrofit efficiency upgrades, and retro-commissioning to achieve energy and demand savings.

Technical training and certification. Increasing capacity in the retro-commissioning service provider network will require technical training and education. Building operators and maintenance personnel will also require training on how to continue to operate and maintain their buildings once the upgrades and retro-commissioning work have been completed.

Commercial audits- Audits are part of the retro-commissioning process, identifying operational and equipment improvements that could improve building performance.

Information, case studies and demonstration. Retro-commissioning represents a major opportunity for energy efficiency in commercial buildings in California. This message needs to be delivered to decision makers throughout the state.

Risk protection. The ability of retro-commissioning services to mitigate risk to building owners should be explored as a component of the risk protection initiative.

Organizations, Associations, and Stakeholders Affected by Initiative

A range of interest groups are involved in the commercial buildings sector, some of whom actively manage buildings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, or exert influence over equipment choice or facility operation. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literature concerning commercial buildings and general supply chain dynamics, the following key groups have been identified in the areas of building commissioning, tune-ups and operations and maintenance.

ASSOCIATIONS – Industry associations involved include those representing: the design professions (architecture, interiors), building operations and maintenance, building owners and operators (e.g., BOMA), facilities managers (IFMA), O&M and facilities publications, and real estate organizations. The work of the US Green Building Council on LEED for existing buildings is particularly relevant. Trade organizations representing commissioning service providers include the California Commissioning Collaborative and the Building Commissioning Association. The tenant is often left out, since their trade organizations are oriented to their core businesses, and not to their workspace considerations.

BUILDING OPERATORS – These actors are highly variable in terms of skills and training (and access to training). Building operators are particularly interested in efficient energy use to the degree that they have responsibility for the energy costs for a building. Some have considerable energy efficiency experience and training.

BUILDING OWNER – Again, lack of information and questions about the reliability of expert advice is endemic. When told “your building isn’t fine like you thought it was,” that assessment is not always believed, nor is it always clear what to do if it is believed. For commissioning and routine tune-ups and O&M, the size of the building and ownership structure may be highly correlated with energy performance—smaller buildings and smaller ownership being the most likely to under-perform.

CONTRACTORS – HVAC contractors, commissioning agents, lighting specialists, and general contractors are all potentially involved in routine replacement and upgrade of equipment and systems.

DESIGNERS – Where tenant improvements and major renovations are involved, designers are also likely participants.

ENERGY EFFICIENCY SERVICE PROVIDERS – Specialized property managers, ESCOs, manufacturer's representatives, retailers, are included in this category. They may be doing the testing and providing the recommendations and making the changes, or just providing parts of that continuum of services.

A newly emerging group is the "systems integrator"—a specialist that can look at buildings from the system perspective.

PROGRAM IMPLEMENTER – Current program implementers are in contact with building owners and operators, targeting decision-makers, supplying information, and recruiting businesses (and public sector properties) in terms of their degree of readiness to participate.

REALTORS – Commercial real estate brokers are sources of information about properties and are involved in facilitating some landlord – tenant lease arrangements.

TENANTS/OCCUPANTS – Most are not in the business of running their buildings. They simply lease space and focus on their core business activities. It was noted that they are concerned that their space be up to par with peers and competitors (at least in visual terms). Unless they have significant energy costs as part of their lease (and few do) and/or their space costs are a significant part of their overall expenses (very rare), they have little reason to be concerned about energy consumption or efficiency.

In addition, problems for tenants can arise in the disruption caused during the installation phase of efficiency measures or in the operations of the actual measure itself. At the same time, tenant concerns for employee and client values (e.g., related to environment and waste of natural resources) can motivate a greater level of everyday concern. Also, there is some recognition of the benefits to productivity and employee welfare of some efficiency alternatives. . As the building occupant the tenant (and the customer) are important market actors, and can be influenced to rent a space, or patronize a business in a space, that provides comfort and services and reasonable prices- all factors that can be enhanced by an effective retro-commissioning program.

Tenant firms and other building occupants have to be aware of efficiency measures in order not to use systems in such a way as to defeat their energy benefits

The market actor network diagram for this initiative is shown in Figure 8 below:

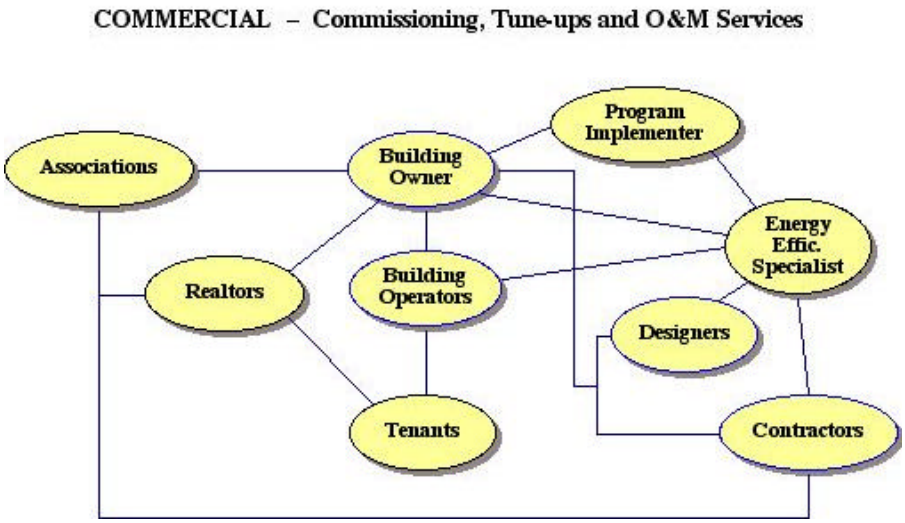


Figure 8. Market Actor Network Diagram for Commissioning and O&M

Market Conditions that will Affect the Success of the Initiative

Market conditions that affect the success of this initiative include:

Green Building Initiative. Executive Order S 20-04 requires the Energy Commission to propose building commissioning guidelines to increase energy efficiency in government and private commercial buildings by July, 2005. This executive order will increase the visibility and interest in retro-commissioning of existing buildings.

Energy Prices. Energy price trends and the implementation of time of use electric rates are two market factors that could stimulate interest in energy efficiency among commercial property owners and managers.

Program availability. Retro-commissioning services may require financial incentives to gain a strong footing in the market. Retro-commissioning programs are a small component of the current portfolio of efficiency programs in California.

Capacity to provide services. The availability of trained commissioning agents and contractors is a critical factor affecting how broadly this initiative can be implemented.

Real Estate market –Retro commissioning can positively differentiate a building as providing lower energy costs and better comfort and productivity for its prospective tenants

Key Barriers Associated with the Success of the Initiative

Key barriers associated with this initiative include:

Lack of awareness of equipment condition. Nonresidential energy equipment maintenance and degradation is often ignored after installation unless there is a breakdown causing equipment to stop running.

Lack of understanding about implications of poor maintenance. There is a general lack of understanding about the impact of poor maintenance practices on equipment efficiency. This barrier is especially true for smaller businesses that do not have system maintenance staff or who do not employ knowledgeable contractors to maintain their systems.

Insufficient documentation. Buildings are often turned over to new owners with a lack of documentation on the design intent of the systems, the intended operation of the control system and the maintenance requirements of the equipment.

Lack of training. Building operators are rarely trained on how to operate the systems they inherit. Training materials are often lacking.

Lack of feedback on building performance. Energy bills may not be available to the people making day to day decisions on how to operate a building. The only feedback that an operator may get is comfort complaints; thus decisions are made principally to minimize these complaints.

Lack of consistency in building O&M. O&M practices vary widely within companies that occupy or operate commercial buildings. Lack of maintenance causes equipment to degrade with attendant loss in efficiency.

Operator skill levels. Operators are tradesmen, but often need professional level skills. Building maintenance and operations are becoming more and more sophisticated, however building operators generally come from a trades background. Operators need more professional level skills in areas such as electronics, control system programming, energy engineering, and electrical troubleshooting.

Split incentives between renters and owners. Like many investments that are intended to reduce energy consumption, a split incentive may exist between the building owner and the occupants when the occupants are responsible for the utility costs. Building owners are reluctant to make investments in energy savings when these costs are not passed along to the tenants. Tenants may be unwilling to pay for investments in a building they do not own. Lease arrangements designed to share the costs and benefits of energy upgrades equitably between owners and tenants are needed to address this issue.

Lack of information, case studies. Commercial building property managers are risk averse and are generally reluctant to try new things without some evidence that trusted peers in their industry have done so successfully. Positive experiences from relevant peers in their business are required to motivate property managers to innovate. Property owners and managers look to manage risk at a reasonable return, rather than maximize return.

Lack of awareness and urgency. Although buildings seldom function optimally, most decisions makers are unaware of the problems or do not feel much urgency to correct a problem.

Consistency in marketplace. Programs placed in the market need time to become established. Commissioning processes will take time to get established and the interaction with the customer may have a longer “learning curve” than with strictly hardware focused programs. Sustained efforts are needed. Short term efforts that come and go may cause more harm than good. .

Lack of quality commissioning agents. Capacity in the marketplace for commissioning service providers is limited.

Profit model for HVAC service. HVAC service companies are an important component of O&M programs. Capacity in the market for HVAC service companies is generally quite good, but the profit models of these businesses do not encourage quality maintenance services.

Strategies for Overcoming These Barriers

Strategies planned under this intervention for overcoming these barriers include:

Training and education for building operators and commissioning agents. There is a need to build capacity in the commissioning service provider market. Training materials and associated programs for building operators and independent commissioning agents needs to be provided.

Benchmarking. Wide spread use of benchmarking tools with appropriate marketing messages encouraging building owners and managers to have their buildings audited, upgraded and retro-commissioned will help to reduce the lack of awareness of the opportunity.

Lease agreements. Tenants may be able to negotiate upgrade provisions into their lease agreements, obligating building owners and property managers to conduct a retro-commissioning process in their buildings on a periodic basis.

Case studies. Case studies highlighting the costs and benefits of commissioning in the commercial marketplace should be developed and presented to key decision makers in a format that they can understand and use.

Incentives. Depending on CPUC policy regarding support for retro-commissioning projects, the Energy Commission may need to address this issue directly with the Legislature.

Marketing and advertising. Executive order S 20-14 should raise the awareness of retro-commissioning opportunities in the marketplace. This message should be supported through additional marketing and advertising to commercial building owners and managers.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Legislative or policy considerations influencing this initiative include:

Retro-commissioning of state buildings. A statewide policy requiring retro-commissioning of state owned or leased buildings should be considered to grow the

market for retro-commissioning services and provide a stable source of retro-commissioning service providers. The LEED-EB guidelines could be used similar to the LEED standards for new construction of state buildings.

Potential for the Initiative to Achieve Market Penetration or Participation

Executive order S 20-14 should pave the way for large scale awareness of retro-commissioning services. This awareness combined with a consistent marketing message and a stable pool of competent service providers should allow the state to achieve significant participation from this initiative.

Potential of the Initiative to Influence Energy Savings or Demand Reduction

Retro-commissioning has the potential to provide significant savings to the state. These activities have been shown to deliver more savings for less cost than most hardware based programs.

Energy Efficient Commercial Leasing

Sector: Commercial

Trigger event: New lease or lease renewal

Intervention type: Voluntary

Intervention Description

This initiative focuses on pushing the market to incorporate energy efficiency improvement clauses into commercial leasing contracts as one of the primary contractual leasing approaches[5]. The split incentives that exist in commercial lease agreements where the tenants are responsible for the energy costs are a barrier to efficiency program participation. This effort would include the development of a standard set of energy efficient leasing agreements that could apply to a wide range of business types, and promotional efforts to place these agreements into the market in a way that moves the market toward these lease structures as an accepted and standard procedure. Leases are generally characterized as:

Gross leases – where the owner pays energy and other building operating and maintenance costs. The owner pays for and reaps the benefits of energy efficiency upgrades to the building. The benefits include improved profitability and net operating income, along with increased property valuation. The owner has no control over the tenant's energy consumption, and is at risk if the tenants operate their space in a manner that causes excess energy consumption.

[5] Cliff Majersik of the Institute for Market Transformation had major input into this section.

Net leases – where the tenant pays the energy and other operating costs. This places the owner in the position of the least risk, since the tenants pay the consequences of their energy behavior. The owner however gives up the opportunity for reaping the benefits of efficiency upgrades.

Existing model leases contain provisions that encourage building owners to make investments in building upgrades and recover these costs from their tenants. The fixed base lease is an arrangement where the owner pays expenses up to certain fixed amount, and the tenant pays any remaining costs. This provides the incentive for the owner to make efficiency upgrades, while limiting the risk if the tenants cause excessive energy consumption. A tenant cost recovery clause attached to net leases allows the owner to recover the costs of the improvements from the tenant energy savings with no net increase in the tenant cost. It is a matter of making these arrangements known to the parties involved in the commercial leasing transaction and educating owners and tenants in general about the benefits of energy efficient buildings.

Nonresidential remodeling and renovation is an important opportunity for making energy efficiency upgrades. According to a recent study, in the first half of the 1990s, nearly 25 percent of all construction dollars went for alterations and another 20 percent for additions. The study projected that by 2010 the market for work on existing buildings will be even larger than it will be for new construction. The primary driver for remodeling and renovation is a change of tenant, or a tenant changing their operations. Most commercial remodeling and renovation is completed in buildings occupied by firms leasing space. Working with leasing agents who specialize in commercial lease space may help implementers to identify space that is coming into the market in sufficient time to promote energy efficiency when subsequent changes to space are being made. An important consideration is the understanding of when leases are about to expire, so that new lease arrangements can be negotiated and efficiency upgrades can be planned.

The elements of this intervention are as follows;

- Use existing model leases, such as the BOMA model lease as a model for best leasing practices. The BOMA model lease has suggestions for clauses that encourage building owners to upgrade the energy efficiency of their properties. Use a fixed base lease arrangement for allocating utility costs. Incorporate these provisions into a standard lease template.
- Place content on the advantages of energy efficient buildings and the existence of model lease clauses into continuing education classes required by the applicable state licensing boards for real estate agents, lawyers, property managers and appraisers. Make the energy efficiency modules one of the mandatory classes.
- Market the advantages of energy efficiency buildings and lease arrangement that encourage investments in efficiency to real estate agents, who are in a position to influence the tenant on property selection and lease terms.

- Use partner networks, such as Energy Star and LEED to educate building owners about model lease provisions that encourage investments in energy efficiency.
- Include a provision into the lease that the building owner or manager should have the building benchmarked at least twice per year, and the benchmarking data shall be reported to the tenants. By engaging in the building benchmarking intervention, the building owner will be exposed to a broad range of services through the benchmarking "portal," where information on retro-commissioning services and building audits will be available.

Importance of Initiative to California's Energy Supplies

Split incentives between tenants and building owners are a major barrier for investment in energy efficiency upgrades to commercial buildings. This initiative seeks to develop strategies where the problem of split incentives can be addressed, allowing efficiency projects to move forward effectively in commercial leased spaces.

Coordinating This Initiative with Other Interventions or Activities

Benchmarking. A benchmarking requirement is one potential element of this initiative.

Audits. Audits play a key role in determining the nature of efficiency upgrades once the issue of split incentives is addressed.

Commissioning. The split incentive may be one barrier to building owners to have their buildings retro-commissioned.

Education and Training. Education and training of real estate agents, property managers, building owners, and real estate lawyers on structuring lease arrangements that favor energy efficiency projects.

Organizations, Associations, and Stakeholders Affected by Initiative

A range of interest groups are involved in the commercial buildings sector, some of whom actively manage buildings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literatures concerning commercial buildings and general supply chain dynamics, the following key groups have been identified in the area of energy efficient commercial leasing.

APPRAISERS – Play a key role when borrowed capital is used to finance significant tenant improvements or extensive renovations that will attract and benefit long-term tenants. One observer noted that the appraiser "holds the keys to letting the improvement project go forward."

ASSOCIATIONS – The Building Owners and Managers Association (BOMA), with local chapters in large cities, works to advance industry best practices, including "model leases" for use by members and non-members.

BUILDING OWNER – Is the "distributor of the energy to the building." Owners and/or property managers typically propose the lease, and they are the parties most interested in buildings and energy use. One large owner noted that "We do what we can by prohibiting electric heaters in their space, etc. They [tenants] get a set amount of power for their space, and if they exceed it they have to pay their fair share."

However, cases where energy costs are either completely passed along to tenants, where energy sales by owners to tenants represent a profit center (and disincentive to promote efficiency), and where energy costs are invisibly bundled into "common area" expenses, are also prevalent.

The practices of large property owners (e.g., REITs and others) are used as role models by other smaller property owners and managers.

LENDERS – Use appraisal information and business plans to assess the likely ROI for the project, the credit-worthiness of the borrower, the loan rate and repayment terms. Also "holds the keys."

REALTORS – In some cases, can influence the adoption of the lease by the prospective tenant. Provides information on competitive market conditions for leased space to owners and property managers that influences leases offered, including price and terms.

STATE OF CALIFORNIA – A very large owner and tenant of commercial real estate.

TENANTS – Are most interested in their core businesses. However, they also are the primary consumers of energy in commercial buildings. Observers noted some instances of shared savings arrangements between owners and tenants when energy efficiency improvements have been adopted. In these cases, tenants have been "willing to participate because they are looking to save money too." On the other hand, there seems to be a very widespread lack of tenant awareness (let alone detailed knowledge) of energy issues and energy efficiency potential and benefits. One observer pointed to "ignorance of energy costs as a number one operating expense." Another identified "ignorance of lease terms" as a more basic problem that is quite common among tenants.

At the same time, there is in some quarters a "…desire of business owners to tell their employees they're doing the right thing and are being green." Also, there is some awareness of non-energy benefits related to worker productivity and reduced absenteeism.

U. S. GOVERNMENT – Another very large owner and tenant of commercial real estate.

UTILITIES – Multiple sources of contact with large property-owning customers. Observers note that utility and user/owner interests may not coincide. An example given was utility interest in peak demand reduction, which almost always comes at

peak business times of day for commercial property owners and tenants. Also, another noted that "anyone that has some experience with utility programs will be skeptical that participation is going to require too much paperwork, that the program won't stick around, and that rebates will never get processed."

The market actor network diagram for this initiative is shown in Figure 9 below:

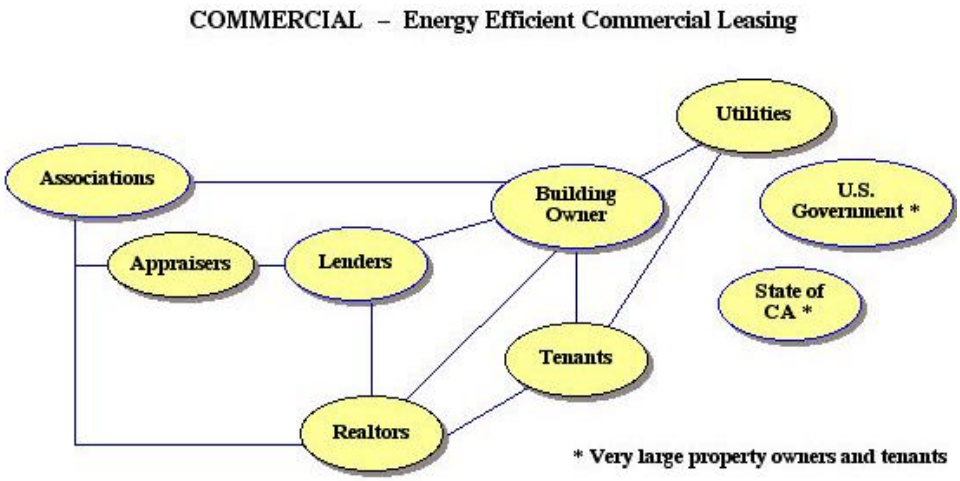


Figure 9. Market Actor Network Diagram for Commercial Leasing

Market Conditions that will Affect the Success of the Initiative

Market conditions that affect the success of this initiative include:

Energy Prices. Energy price trends and the implementation of time of use electric rates are two market factors that could stimulate interest in energy efficiency among commercial property owners and managers.

Vacancy rates. Competitiveness in the market for commercial building space will affect the ability of tenants to negotiate specific terms and conditions in the lease agreement.

Key Barriers Associated with the Success of the Initiative

Key barriers that affect the success of the initiate include:

Lack of knowledge on the part of the tenant. Tenants have a general lack of knowledge on lease provisions, what is a fair lease, and how energy costs are allocated. Tenants tend to rely on their real estate agent to advise them on lease terms.

Lack of knowledge on the part of lease writer. Leases are generally written by real estate lawyers that do not have ongoing interactions with landlord or tenant and do not understand the dynamics of energy use within the various tenants in the building

Property tax concern. Property owners have a concern that efficiency improvements will cause property taxes to go up.

Energy Star focus on building owners. Tenants who participate in the process of efficiency upgrades should be able to gain recognition for their contributions. Currently, the Energy Star designation is provided to the building owner. Acknowledgement of the tenant contributions and duplicate recognition materials such as certificates, plaques, and building registry should be provided.

Strategies for Overcoming These Barriers

Strategies to overcome these barriers include:

Encourage owners to move away from net leases. Net lease energy costs do not show on building owner balance sheet, so it is hard to incorporate the improvements in net operating income from energy efficiency in the building appraisal value. Convince owners that it is in their best interest to move to a different lease arrangement through marketing and training.

Incorporate leasing provisions into LEED. Increase the penetration of efficient lease arrangements by making these a component of rating systems such as LEED. It may not be practical to modify leases for all tenants during the building application process, but the rating requirements could offer optional credits for using this type of lease in newly leased space.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Discussions with the U.S. Green Buildings Council on strategies to include leasing arrangements that encourage efficiency investments in the LEED rating system for existing buildings can be an important driver for making these arrangements more commonplace. Property tax abatement for efficiency upgrades is a local government issue, but the state could provide leadership in this area.

Potential for the Initiative to Achieve Market Penetration or Participation

Split incentives are a major barrier to investments in energy efficiency in commercial leased space. This initiative, if successful, has the potential for increasing the number of efficiency projects undertaken in commercial buildings. The potential of this initiative to transform the structure of commercial leasing arrangements is not known. Additional market research and/or pilot testing of these concepts will be needed.

Potential of the Initiative to Influence Energy Savings or Demand Reduction

Energy and demand savings potential in commercial buildings is significant and this initiative can help reduce one of the principal barriers to efficiency investments in commercial leased space.

Demand Response

Sector: Residential and Commercial

Trigger event: Low Utility Reserve Margins, Brownouts and Rolling Blackouts, High Demand Charges, Time-of –use rates, utility service connection.

Intervention type: Both Voluntary and Mandatory

Deregulation of the electricity market has been accompanied by numerous problems including generation shortages, transmission congestion, and wholesale price volatility. The 2001 California energy crisis was, in part, a result of deregulation that allowed for market manipulation that inevitably lowered available generation capacity resulting in increased wholesale prices and reduced system reliability.

Following the 2001 energy crisis, demand response in California has become an increasingly important policy and program initiative. Demand response refers to customer-side actions taken to reduce facility usage and demand in response to signals or rates or other means provided by the serving utility. Demand response can act to reduce and/or shift load from the electrical grid during periods of electrical system instability, and prevent a consequent breakdown of the electric system. The CPUC and the Energy Commission are currently developing a real-time demand-side infrastructure to respond to supply-side problems and prevent further blackouts in California. We believe that policy initiatives should be put forth to expedite this process.

There are two parts to demand response, first a signal must be issued that demand response is needed, and second, there must be “technology” in place to respond to the signal. The consensus within the demand response arena is for this signal to be the price of electricity, and that consumers should be permitted to act accordingly. The options to reduce energy use or correspondingly, demand, may be a number of things ranging from people manually turning off their air conditioners and clothes dryers to use of thermal storage technologies as well as automated demand response technologies for larger buildings. Large potential demand reductions seem to be likely by using automated demand response to activate enabling technologies that reduce end-use energy consumption in conjunction with demand response pricing signals. Dynamic pricing rates (real-time pricing or RTP) offer consumers the incentive to shift load, especially during peak emergency times when the price can several times higher than standard rates.

The dynamic nature of pricing in a real-time market will cause concern among consumers who are unwilling to adapt to dynamic rates. The unwillingness stems from a number of sources including a lack of education, as many consumers are afraid they will end up paying more for energy bills, although surveys have shown that the average bill actually falls. Lack of operational flexibility is a real issue of significance for many commercial establishments. Furthermore, for larger

corporations, proper hedging options to buy electricity ahead of time may mitigate potential problems and help those businesses that are unable to curtail electricity demand during peak hours. Helping businesses and residents understand the options available to them to permit normal functioning while helping to reduce electrical demand is a service that should be facilitated by this initiative.

Demand response programs may be grouped into two broad categories, reliability-based and marketed-based. Reliability-based programs are triggered during emergency conditions when the stability of the electrical system is in threat. Market-based programs are triggered by wholesale electric prices and offer incentives during general market conditions. The ideal situation is to use both programs in tandem, using market-based programs as a tier one program in which all consumers (including businesses) are enrolled, and reliability-based programs as a second tier in which as many consumers as possible are voluntarily enrolled. Eventually, it should be the goal of California to have all consumers enrolled in both programs where applicable. The following are examples of reliability-based and market-based demand response programs taken from the paper published by Heffner

Reliability-based Demand Response Programs

For reliability-based demand response programs, customers have no override capability; that is, there is already a pre-set amount of reductions that will occur at their facility and these reductions are tripped with a specific signal. This method is more expensive to implement, and many customers do not like it because they are not in control of the load reduction. However, it is also the mandatory element is a key feature of reliability-based demand response. The reduction controls are fixed and the customer must give up the power. Only a few customers are in a position to agree to this type of structure, and it is therefore hard to recruit customers for reliability-based demand response programs described. Savings can be impressive, as programs that have used this approach have reported:

- Record setting peaks occurred throughout New England and the Mid-Atlantic regions during the week of August 7, 2004. The Contingency programs of the New York Independent System Operator (NYISO), PJM Interconnection (PJM), ISO – New England (ISO-NE), and Baltimore Gas and Electric (BG&E) were all operated during this period, providing critical relief to the strained grid. The NYISO Emergency Demand Response Program (EDRP) provided an average demand response of 425 MW on four occasions, equivalent to approximately 25 percent of the total system reserve requirement. An analysis of the program impact estimates that, for a single hour during this period, the EDRP likely provided reliability benefits of between $870,000 and $3,484,000. The program is estimated to have resulted in an additional $16.8 million dollars in collateral benefits, associated with reductions in electricity prices and volatility, over the duration of the summer.
- The big surprise was California, with only one contingency event throughout the entire summer, despite the North American Electric Reliability Council's (NERC) prediction of more than 260 hours of rolling blackouts. A major contributing factor

was the extensive level of peak demand reduction (on the order of 10 percent) resulting from a combination of energy efficiency and demand response programs, voluntary initiatives, increases in electricity rates, and widespread media attention on the state's electricity crisis. On the single curtailment day, approximately 800 MW was curtailed, the majority of which is attributable to the interruptible and direct load control programs of Southern California Edison.

- Xcel's Electric Reduction Savings Program (U1) also operated quite frequently in the Summer of 2001, with 20 events. However, the program was not generally operated in response to explicit reliability conditions (e.g., generation shortages or transmission constraints), but was, instead, operated so that Xcel could avoid exceeding Mid-Continent Area Power Pool (MAPP) authorization levels and paying the associated fines.

Market-based Demand Response Programs

Market-based demand response programs are also known as price response programs. The single most important factor for market-based programs is the belief that price change or benefit is real. Most programs need some sort of automated response to take full advantage of the price changes. There also needs to be some sort of forecast with enough notice to allow customers without automated devices to take some action. Price forecasts may occur a day-ahead and still provide a more accurate real-time pricing scheme. Benefits also need to be known to the customer, and if such programs are implemented, customers should receive some sort of validated savings report. Some examples are:

- In the Pacific Northwest, several day-of and day-ahead bidding programs had high activity levels during the Winter and Spring of 2001, driven by high wholesale electricity prices. However, in the Summer 2001, there was a dramatic drop-off in demand response program activity, apparently driven largely by the impacts of Federal Energy Regulatory Commission (FERC) price mitigation measures. Many programs base the incentive for participants on roughly a 50/50 sharing of the avoided wholesale purchase cost. With the soft price cap of approximately $92/MWh, the incentive available for participants dropped down into the $40-50/MWh range, which is well below the level at which most end-users would be willing to bid in load. For example, the day-ahead bidding component to Portland General Electric's (PGE) Demand Buy Back Program (Q), which had been active up until that point, received no bids once the price caps were implemented. However, PGE's program did provide curtailments on an almost daily basis during the summer through "term" events that had been procured prior to the drop in wholesale prices (i.e., demand buy-back initiatives). In California, participants submitted bids for the Demand Bidding Program regularly throughout the summer, but none were accepted by the California Department of Water Resources because prices remained below the minimum available bid price of $100/MWh.
- In the Midwest, program activity was low as a result of the soft wholesale electricity prices throughout the region. Wabash Valley Power Authority's Customer Payback Plan was originally offered with a $200/MWh strike price, but

prices remained well below this level, and the strike price was dropped to $50/MWh.

- During the August 2004 heat wave on the East Coast, real time electricity prices reached $1000/MWh in both ISO-NE and NYISO markets, and more than $900/MWh in PJM's region. All three programs provided load relief during these periods, although the level of load curtailment was generally small. The NYISO's Day Ahead Demand Response Program (L1) was available for bidding on a continual basis and operated throughout the summer on 24 occasions.

Rate Structure

Rate structures have an important impact in the area of demand response by varying peak and off-peak rates to offer consumers an incentive to shift electric use from peak to off-peak hours. In order for the rate structure to be effective, consumers must be educated about the rate structure and be willing to respond accordingly. Currently, there are three typical rate structures that have been developed, time of use (TOU), critical peak pricing (CPP), and real-time pricing (RTP).

TOU rates typically breakdown the rate structure into three time blocks: peak, shoulder, and off-peak with peak at a higher rate and off-peak at a lower rate. The TOU rates are published in advance for an entire season, and cannot adapt to changing weather conditions and grid reliability issues in real-time. CPP occurs only 1 percent of real-time, and comes into effect a few days a year when energy is expensive or systems are critical or near critical to failure. RTP is the most dynamic solution for rate structure, and provides hourly real-time marginal cost of kWh. RTP is capable of responding to weather conditions, wholesale energy rates, and equipment failure. Both critical peak pricing and real-time pricing rates may use a day ahead notification to allow consumers more response time. Furthermore, CPP may be used in conjunction with either TOU rates to offer stability of rates except during emergency periods.

Currently, the Energy Commission and the CPUC are jointly developing policy relating to rate structure. The vision is for CPP to become the default rate for residential, small commercial, and large customers (<200 kW to 1 MW) and RTP to become the default rate for very large customers (> 1MW). The shift to CPP and RTP would seek to prevent a breakdown in the electricity network. As mentioned earlier, consumers need to be educated on the potential financial benefits from a demand rate structure, as many are unwilling to take on the risk of having a higher energy bill.

Another consideration is that many consumers do not see price response as demand response, even though they are coupled together. There is also a need to develop demand response programs alongside demand response pricing to bring out its full effect. We believe that there should be movement for a mandatory demand response rate structure.

A study conducted by the Electricity Markets and Policy Group on RTP in New York showed that commercial customers are least responsive to demand response in

connection with rate structure. Overall, government and institutions are the most responsive to real-time pricing.

Automated Demand Response Technologies

Technology advances enable the use of automated demand response programs by allowing buildings to automatically respond to changes in electric system reliability. The idea is that a control system such as an energy management system (EMS) or energy information system (EIS) can receive signals to shed load and can then execute an automated load shedding schedule/program that turns off or modulates building systems to achieve the desired load reduction. This information can be sent in numerous formats, including as price signals via RTP. The signal, in this example a price signal, would be sent from the utility to an EMS or EIS. The EMS or EIS will be able to read the price signal and perform a number of automated building functions such as reduce lighting power, increase thermostat setpoint temperatures, or reprogram chiller activity to perform at a later time. The automated demand response program would ensure that load shedding is occurring during an energy crisis in real-time, and would not be dependent on human involvement. Although there are currently technologies to support demand response programs, since this is a new field, more enabling technologies need to be developed to support this initiative so demand response may achieve its full potential of curtailing demand during times of crisis. Currently, automated demand response programs have been tested successfully in larger facilities. However, as technology improves and cost reductions occur in providing and operating automated devices, the scope for these programs should start to include smaller commercial facilities and residences.

Enabling Technologies Development

To take advantage of demand response pricing, enabling technologies must be developed. Some of the technologies are as follows:

- Interval meters with two-way communications capability which allows custom utility bills to reflect the customer's actual usage pattern rather than an "average" load profile for that customer class
- Multiple, user-friendly communication pathways to notify customers of load curtailment events
- Energy information tools that enable near-real-time access to interval load data, analyze load curtailment performance relative to baseline usage, and provide diagnostics to facility operators on potential loads to target for curtailment
- Demand reduction strategies that are optimized to meet differing high-price or electric system emergency scenarios
- Load controllers and building energy management control systems that are optimized for demand response, and which facilitate automation of load curtailment strategies at the end use level

- End-use equipment that can operate with reduced power and can therefore provide facility HVAC, water heating or other functions during the demand crisis. Storage technologies are well suited to “riding out” and emergency. How these storage technologies can enhance a modern demand response program is an overlooked question that will receive attention in this initiative
- Onsite generation equipment used with appropriate interconnect devices and controls to meet the needs of the facility under the load curtailment conditions imposed on the facility

There are also several technologies that are currently being researched under the PIER program. These enabling technologies essentially receive a price signal and are able to adjust loads accordingly. For example, the temperature set point for a smart thermostat might vary as a function of the price signal.

Importance of Initiative to California’s Energy Supplies

A blackout in California costs consumers and businesses millions of dollars. The importance of demand response is to prevent future blackouts and preserve the reliability of the entire electric system. It is recommended that California move to a RTP structure that will allow consumers to be more sensitive to real-time energy dynamics and prices. That is, when the electric system is instable, prices will be high enough for consumers to want to curtail load. For larger facilities, a move towards automated buildings with incentive programs might act as a complementary effort. Incentives may not be needed, since prices that reflect the cost of service should provide the economic incentive to participate. Proper education on the amount of money that may be saved with such automation should be sufficient. As a result, there must be coordination between demand response pricing and demand response measures. As communications, controls and end-use technologies develop to enable demand response benefits to be realized, demand response will become an increasingly powerful tool.

Coordinating this Initiative with Other Interventions or Activities

- The initiative devoted to developing and disseminating Information (Demonstrations and Case studies and Information to All) will play a key role in the success of a demand response intervention strategy. Consumers, business owners, and large corporations all require better information to understand the implications of this initiative. The complexity of the information increases as one moves from the residential customer to the small commercial and ultimately to large (high demand) industrial customers. Without this background information, the probability of success for demand response is very low.
- Initiatives that assess and optimize building or facility performance (Audits; Benchmarking; Retro-Commissioning and O&M, Certification, Inspections and Energy Ratings, Tune-ups and O&M) are a critical piece in maximizing the success of a demand response initiative. All of these initiatives are directed towards understanding and optimizing building “system” performance.

- The Procurement initiative is in most ways an upstream/manufacturer partnership and as such will need to be an integral part of this initiative.
- Interagency coordination is essential in providing a smooth transition to a marketplace where demand response has a prominent presence. The CEC, CPUC, California ISO, and utilities must work together to successfully implement a demand response initiative.
- Training programs may need to be developed to assure that new products developed in this initiative are well understood and can be readily specified, installed, operated and maintained.

Organizations, Associations, and Stakeholders Affected by the Manufacturing Partnership Initiative

There are several interest groups that are vital to produce the results necessary for demand response in rate structure. The legislature must provide policy leadership and direction with support from the Energy Commission and the CPUC. After legislation is passed, the utilities must work with consumer groups and industry associations to develop and implement the appropriate rate structures. A key role for consumer groups and industry associations is to help educate residential and commercial customers, allowing them to overcome their fear of uncertainty.

Education is a key component of a successful demand response rate structure. However, there are differences between residential, small, and medium commercial customers and largest commercial and retail customers. The information required by the residential customers is educational in the sense that they need to understand the pricing structure and what demand response is. One way to achieve this is better information incorporated into the utility bill. It has been found that smaller utility customers generally do not understand the billing format, and just pay the bill. Larger customers usually understand the concept of demand response and the corresponding financial incentives, but require education on what actions to take and how to maximize the benefits. Technology vendors also need the sales volume and motivation to reduce the price of advanced meter products to allow for wide-spread adoption of demand response technology. Furthermore the California Independent System Operator (CA ISO) would need to coordinate with the utility and customer metering to send consistent, appropriate signals about real-time demand and system reliability.

Key interest groups and their contributions are listed below.

<u>Associations</u> – Some key consumer watchdog groups and low-income advocacy organizations have strong criticism of equity impacts of demand response.

<u>CA ISO</u> – CA ISO is responsible for the electric system loads. They have the authority to recognize a variety of approaches to the management of those loads, including various forms of demand response.

<u>Customers</u> – Both residential and commercial customers are likely unfamiliar with system capacity issues and demand response alternatives. Uptake on TOU rate

offerings has been small. Participation in experimental TOU programs has been low (although consumers who did participate understood their bills better and liked rates more than had been expected). As one observer noted: “It all comes down to cost for the customer. Many customers will find this to be a favorable change, but customers that cannot change their load will not like it. Those customers that are putting extra pressure on the system at peak times (i.e. those that will have higher bills as a result of the change) should probably be paying for it.” It is also the case that some consumers’ energy use patterns are already largely “off peak”, (.e.g. as a result of work schedules). In these cases, TOU tariffs would provide immediate rewards. In most cases, however, it is expected that behavior changes, hardware improvements, and new control systems would be adopted to cut on-peak loads at the household or firm level.

In terms of nonresidential consumers, it was noted that small commercial energy users may be unlikely to feel that turning down their air conditioning can make a significant difference. In addition, they have reasonable concerns about losing sales, producing lower quality products, increasing their energy costs, and being inconvenienced. However, there was also a sense among interviewees and panel members that there can be some significant benefits to small commercial customers from enhanced automation associated with demand response, and that there is a willingness in the sector to “do the right thing”, as long as their needs and circumstances are taken into account.

Energy efficiency service providers – Energy raters, auditors, consulting engineers, HVAC contractors, and building control firms compose the limited existing technical assistance infrastructure for demand response.

Manufacturers – Technology developers and vendors are offering an increasing number of metering, control, data acquisition, and analytic products and services to support demand response. Several observers noted the relatively high costs of installing some of the technology needed to fully implement demand response on a building, let alone on an enterprise scale.

State of California – Evaluate and approve time-dependent tariffs through the CPUC. Conduct demand response experiments and demand response hardware research and development and policy analysis through the Energy Commission. While the relative role of the two agencies is fairly distinct and complementary, several observers expressed concern about coordination of policies and programs in the future. For example, one interviewee noted “I only worry about conflicting legislation or policies because they are throwing too many things on the table that are conflicting and confusing to everyone.”

Utilities – They implement time-dependent rate structures and provide interval metering and billing services. Utility demand response initiatives and rates are negotiated with the CPUC. Over the past two decades, California utilities have implemented a variety of load-shedding, load-shifting, remote load-control programs, and time-of-use rate tariffs. They have also experimented with demand markets and smart control technologies. There are good reasons for this. As one observer noted, “the utility is the one that is avoiding the cost that your load creates”. Within the

utility, a variety of individuals are involved in demand response, including resources acquisition, transmission, dispatch, key accounts management, and energy efficiency units. Utilities also maintain a variety of communications channels with customers of various sizes and load profiles.

The market actor network diagram for this initiative is shown in Figure 10 below:

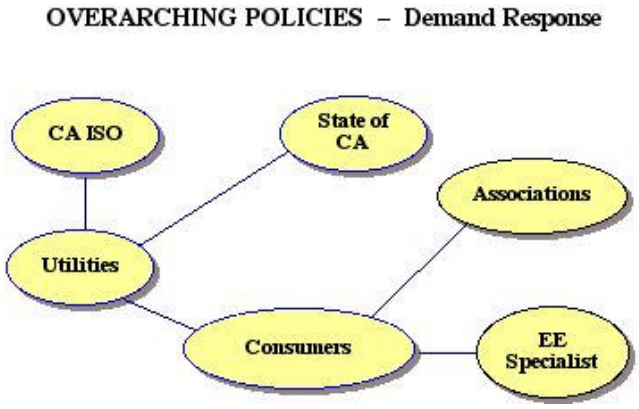


Figure 10. Market Actor Network Diagram for Demand Response

Market Conditions Affecting Success of the Initiative

California Electricity Market: California's short-term success (or lack thereof) in managing peak electrical demand and obtaining sufficient electrical supply is the primary factor affecting the potential success of a demand response initiative. The sooner this issue comes to a head, the sooner it must be dealt with to avoid a repeat of the 2001 crisis.

Customer Motivation. Ample reserve margins and problem-free summers may have lulled some market participants into complacency. Experience shows that supply and demand are cyclical. It is almost certain that problems will arise unless actions are taken to increase supply or to reduce demand. Far thinking participants will promote the lowest cost, most environmentally beneficial approaches and develop and implement an integrated resource plan that includes aggressive demand response efforts.

Political Will: California's energy future is one of the largest issues confronting the Governor and lawmakers in Sacramento. Many forces are at work influencing the direction of California's energy policy and the level of investment in California's energy future. The level of activity in Sacramento is strongly tied to the stability of the California electricity market.

Energy Prices: Rising energy prices will increase the pressure to develop and implement time-of-use and real time electricity pricing.

Availability of Demand Response Technologies and Metering Equipment: Additional product development and R&D is needed to provide the equipment, controls, and metering devices for implementing a demand response initiative.

Key Barriers Associated with the Success of the Initiative

Customer knowledge. Consumers do not understand the potential financial benefits of being involved in a demand response program. As a result, consumers are unwilling to take on the risks of having higher energy bills as a result of taking on demand response responsibilities. Information initiatives need to be implemented so consumers are aware that they can potentially save more by embracing demand response.

Partitioning energy efficiency and demand response. Another barrier is that policy makers tend to think of energy efficiency and demand response as separate issues. Demand response addresses load reduction during critical time intervals, whereas energy efficiency addresses total energy consumption regardless of time of use. However, in order for demand response to be most effective, it needs to be tied into energy efficiency measures. Currently, funds from the Public Goods Charge (PGC) are unable to fund demand response programs. We believe that the PGC funds scope should be expanded to allow for technology development and programs for demand response in addition to energy efficiency.

Policy toward thermal energy storage systems. Thermal storage technologies have great potential to provide demand reductions in commercial facilities but have been largely overlooked in recent years. Several reasons are likely for the lack of reliance on thermal storage (particularly cool storage) as a viable option. Some of these may be: poor experience with early versions of the technology; overselling by overzealous, less capable practitioners; customer angst over lack of stability of utility programs (including changes in rates or incentives that make it difficult to operate a system economically); and lack of documentation of successful installations as a cost effective means of reducing both peak demands and energy bills.

Varying ability to respond. Consumers may also be unwilling to compromise comfort for monetary savings. For example, large customers in the service industry like hotels and restaurants are not likely to want to take on the risk of having facility comfort conditions that would create unfavorable guest satisfaction and would thus be unwilling to lower air conditioning set point during occupied periods. These consumers are most likely to oppose the peak rates; however, hedging options mentioned earlier may provide a way out for these consumers who have more inelastic demand for energy.

Meter readers. Labor unions for those workers that read meters will most likely oppose the change to RTP. RTP requires the use of pricing signals which must be sent in real-time. As a result, the utility sending the pricing signal must also be able to remotely record electric use in real-time and would have no need for meter readers. Meter readers argue that they also provide safety benefits by being at the home once a month and can therefore check for gas leaks and other safety issues. Labor unions believe that automated systems will put people out of work.

Program design issues. Some programs actually counter-act the notion of demand response. For example, the Standard Performance Contract incentives provide rebates for high efficiency chillers. If a building uses an alternative method such as thermal energy storage, the owner gets a lower incentive from the program because

the owner installed fewer chillers. However, more chillers actually raise the demand for electricity and put pressure on the system. Eliminating this disincentive may help reduce load in California, or may just increase energy usage by having less energy efficient chillers installed. A better strategy might be to keep the high efficiency chiller incentive in place but to provide even greater incentives for cool storage.

Strategies for Overcoming Barriers Associated with the Success of the Initiative

- Overcome customer reluctance to embrace demand response by making demand response participation mandatory rather than have it as an optional program.
- Capture the benefits of both energy efficiency and demand response by expanding the scope of public goods charge funds to allow for technology development and programs for demand response in addition to energy efficiency.
- Provide case studies of successful energy storage facilities to help overcome customer and specifier resistance to change. Encourage rates and signals that permit effective charging of storage to enable subsequent cost effective demand response. Provide assurances that rates and conditions will remain in place for sufficient duration to permit cool storage systems to make it economically attractive to construct and operate these systems. Develop standards for installation and operation that will prevent unqualified practitioners and poorly designed and constructed systems from entering the market in California. Eliminate disincentives to installing cool storage and its smaller chillers vs. larger non-storage chillers.
- Provide strategies and disseminate information on how to embrace demand response without affecting occupant comfort and productivity. These would include case studies that use occupancy sensors, cool storage and other technologies for maintaining the occupied facility conditions within acceptable limits.
- Change rate structure in California to follow a TOU for low to medium energy customers and a dynamic RTP structure for large customers.
- Advance technologies that are enabled to read pricing signals and make commonplace. Reduce costs associated with metering technologies.
- Offer programs such as enhanced automation that help companies maximize benefits from RTP and build in automation to buildings where possible.
- Develop informational programs to educate consumers about RTP and how it can help save money.
- Continued research for technologies through PIER and other programs.
- Building and appliance standards should also address demand response programs aside from energy efficiency. That is, if we slowly implement

automated load shedding features into appliances, then demand response pricing signals will be more fully used.

- There should be a phase in period for rate tariff changes. That is, there could be a 6 month to 1 year transition period where customers would be provided with a "shadow bill" that shows them what they would be paying in the dynamic pricing rate structure and what they are currently paying. Furthermore, the bill can point out the peak times that consumers can save money, and would allow them to tweak their load profiles accordingly and see for themselves if savings can be achieved. For those customers that see their shadow bill increasing during the transition period, it gives them an opportunity to understand why their bill is changing and think of ways to change their usage patterns to reduce costs.
- Provide consumers with information on what appliances consume the most on-peak power that could drives up their bill.
- Educate people about peak and off-peak prices, and why electricity costs vary with time.

Legislation or Policy Considerations that can Influence the Success of the Initiative

As indicated in the Strategy section above, more resources need to be applied to developing and encouraging the use of demand response technologies and strategies. These actions can be taken more thoughtfully and efficiently in anticipation of a crisis rather than in reaction to a crisis.

Potential for the Initiative to Achieve Market Penetration or Participation

If the rate structure change is mandatory, the penetration rate for this particular initiative would be 100 percent. However, the full effects of demand response would require consumers to actually change their load structures. Interviewees have suggested that approximately 50-70 percent of consumers would change their load structure, with some consumers having an inelastic load schedule.

Upstream Interventions/Manufacturing Partnerships

Sector; Residential and Commercial

Trigger event: Lack of suitable off-the shelf energy efficient equipment

Intervention type: Voluntary

This initiative uses upstream interventions that focus on the manufacturer. Elements of the initiative include R&D to develop new products, and incentives provided to the manufacturer to reduce the cost of manufacturer goods sold. Information dissemination, including documentation and distribution of case study and demonstration material driven by manufacturer efforts to market the energy efficient technology is another key element of the initiative. Procurement and purchase incentives are another upstream intervention, discussed separately, that will reduce unit manufacturing and marketing cost through economies of scale.

All of these interventions are designed to reduce the risk and cost of producing and deploying new energy efficient products. Due to mark-ups occurring throughout the distribution chain, incentives or initiatives applied at the manufacturer level may be more cost effective than those applied at the consumer level. These upstream activities stimulate the development of new energy efficient products at an accelerated pace, with a higher efficiency level and lower manufacturing cost than would otherwise be achieved. In a reasonably functioning market, expenditures applied to upstream participants to reduce manufacturing costs would be leveraged by avoiding the mark-ups that would otherwise be applied to these costs.

Linkages to other initiatives include a description of the role of information products needed to maximize market penetration of energy efficient products that are the focus of these partnerships. Other issues addressed in the following sections include the importance and potential of the initiative to affect California's energy supplies, the interest groups that most influence and are most affected by the initiative, market conditions and key barriers that will affect the success of the initiative, and strategies for overcoming the barriers and maximizing market penetration and participation.

Initiative Elements

The following paragraphs describe three initiative elements; R&D partnerships, upstream incentives, and upstream technology transfer. A brief description of a closely related intervention, upstream procurement support is also included.

R&D Partnerships

This part of the initiative discusses the establishment of statewide R&D partnerships with key manufacturers to increase the availability and to reduce the cost of high

efficiency products in California. The Energy Commission/PIER program and others have been providing financial and management support for development projects with manufacturers for many years. Products such as horizontal axis clothes washers, high efficiency heat pumps and furnaces, advanced lighting controls and fixtures and electronic thermostats are a few that come to mind that were jump-started with R&D funds provided to manufacturers from government or private research management organizations. Funds can be provided for efforts ranging from proof of concept to bench testing to pilot production and field demonstration. Developing effective cost-shared product R&D programs with major manufacturers requires some legwork, patience and perseverance in getting to know the decision makers in these organizations and developing a sense of trust between the manufacturer and the funder. Both parties need to understand and respect each others objectives.

The funds provided by Energy Commission/PIER, for example, helps offset some of the financial risk and opportunity risk of manufacturer's efforts to develop higher efficiency products that will benefit the public at large. The structure of the partnerships has taken on several forms, including cost-shared development projects. Financial arrangements for these partnerships can include an exclusive royalty-bearing license between the manufacturer and funder with a due-diligence clause to protect both parties. Other efforts have included design competitions with a monetary reward or a large purchase order as the prize. Some of these high profile "golden carrot" efforts have succeeded in accelerating the development of much higher efficiency products such as domestic refrigerators.

While California is a large market and can be a lucrative market for some products and manufacturers, it would be desirable to attract national partnerships with manufacturers and national R&D organizations (such as the U.S Department of Energy (DOE), the Electric Power Research Institute (EPRI), the Gas Technology Institute (GTI) or the Association of State Energy Research and Technology Transfer Institutions (ASERTTI) to defray the costs of development and to increase the market opportunity to attract aggressive efforts by prominent manufacturers.

Some activities of this type are currently underway in the Energy Commission PIER program in areas such as power supplies, residential and commercial heating, ventilating and air-conditioning, lighting, and controls and should continue to be encouraged. The PIER program has the infrastructure in place to continue to look for opportunities to create these partnerships to provide energy efficient products in areas that have high improvement potential and that can also satisfy customer needs. Additional funding is recommended to define these opportunities in the areas that have the greatest potential to reduce energy use and peak demand.

Upstream energy efficiency incentives

Rebates or other incentives should be provided to the manufacturer rather than to the consumer as is often the case. There are price mark-ups in each step of the product distribution chain to afford each market participant a profit. Reducing the price of a manufactured article through manufacturer rebates should logically result in a "retail" price reduction that includes all the mark-ups that would have otherwise

been applied to the original manufacturer's price (without the rebates). In other words, each rebate dollar provided to the manufacturer would be equivalent to reducing the consumer price by perhaps $1.50 to $2.00 after all the mark-ups. This argument could be extended to the "outside" investments in product R&D, and technology transfer as well, where the application of "upstream" funding support reduces the manufacturer's costs. If these cost economies are passed on to the distribution chain by the manufacturer and the distribution participants add only their normal mark-up, the consumer should benefit by a price reduction that reflects a leveraging of the R&D and technology transfer funding provided by the "outside" agencies.

Upstream technology transfer efforts

After the products are developed and demonstrated, technology transfer assistance should be applied. One of the main flaws in programs to develop energy efficient products in the past has been a lack of aggressive, continual promotion of the merits of the technology well beyond the initial market introduction of the product. A measured ongoing investment in technology transfer materials and mechanisms that differentiate the advantages of the energy efficient product from it's less efficient (and likely a lower cost) competitive product, can substantially increase the market penetration of the energy efficient product. These outlays are likely to be modest compared to the initial R&D investment applied to develop the product, but in the past these outlays have not been deemed research outlays consistent with the charter of the research organization and therefore have received a low priority for funding. The Energy Commission PIER program budgets market connection funds for each R&D project that, in part, addresses this issue. One problem is that these funds are usually applied concurrently with the R&D funds with perhaps a few months additional time to complete the technology transfer activities and deliverables.

What is needed is a technology transfer/market connection effort that extends well beyond the completion of the RD&D (research, development and demonstration) for perhaps two years or more to assure that the energy efficient products get a chance to "grow up" before they are overwhelmed by cheaper, otherwise easier to sell less efficient products. Within narrow limits manufacturers will sell whatever is easiest to sell. It is up to the energy efficiency advocates to provide the information and the infrastructure support to make efficiency an easy sell. The technology transfer products should be designed to overcome market barriers, including a lack of familiarity with the equipment, uncertainties in how the equipment will perform, lack of knowledge of product or service availability, lack of understanding of installation, operating and maintenance issues, transaction costs, and resistance to change with well designed and presented product directories, case studies, and guidelines for specifying, buying, installing, operating, monitoring, maintaining and servicing the energy efficient products developed in this upstream initiative.

The technology transfer materials can be disseminated by the manufacturers and their distribution networks or through industry channels (see Information, Case Studies and Demonstrations). The upstream products should be designed to mesh with the manufacturers sales efforts and should be jointly "branded" by the

manufacturer and the funders. Joint presentations and meetings should also be encouraged to increase the leverage of the partners in attracting buyers and specifiers to accept the new products.

Upstream procurement support

Purchasing standards and procurement programs can provide a platform that encourages manufacturers to produce energy efficient products in sufficient quantities to assure that costs can be kept down while allowing a reasonable profit to be made. Federal, state and local governments can join together with utilities and other major organizations to determine reasonable product specifications that can satisfy their needs and will have high enough production volume to provide economies of scale for the manufacturers. Purchase contracts for products meeting these specifications can allay much of the tooling and production risk. Getting product volume up and unit cost down will hopefully have a snowball effect where, as price comes down, other consumers enter the market and increase sales volume, further reducing cost and price. Products such as power supplies or dimmable electronic ballasts that are sold or could be sold in large quantities and can be readily specified in ways that meet a broad set of purchaser needs are well suited to this type of effort. Corollaries of these programs could include design competitions such as the “golden carrot” refrigerator program of the 90’s where manufacturers competed to produce the best product and the winner(s) would be guaranteed a reasonable level of sales to offset the R&D costs. For more details see Energy Efficient Procurement and Procurement Support initiative.

Importance of Initiative to California’s Energy Supplies

California has been a leader in increasing the energy efficiency of buildings and as such, manufacturers look to California to play a leadership role in bringing energy efficient products to the market and in encouraging their market penetration. Providing better power supplies, space conditioning, appliances, water heating and lighting are essential to meet the energy efficiency and demand targets. A well coordinated program of upstream interventions that include product development, manufacturer incentives, market connections that overcome market barriers and purchasing support that increases product demand will play a key role in improving the effectiveness of energy use in California. It is important for California government to take the lead and encourage partnerships to develop and deploy energy efficient products that have a strong impact on California and the nation.

Coordination With Other Interventions

The procurement initiative should be coordinated with several other initiatives. These include:

- The Information, Case Studies and Demonstrations and Information to All Homeowners initiatives will overlap with this initiative in the subject matter provided. The distribution channels used in this initiative will have the

manufacturer as the focal point and leader. Overcoming market barriers should be addressed in a manner similar to that described in this initiative.

- Initiatives that measure building performance (Audits; Benchmarking; Commissioning, Certification, Tune-ups and O&M, Inspections and Energy Ratings, Tune-ups and O&M) will uncover deficiencies in technology and practice and cost effectiveness that may provide targets for upstream interventions to create new, cost effective products to fill these unsatisfied needs.
- The procurement initiative is in most ways an upstream/manufacturer partnership and as such will need to be an integral part of this initiative.
- The Demand Response initiative is likely to uncover unmet development and commercialization needs that can best be met with this initiative.
- Training programs may need to be developed to assure that new products developed in this initiative are well understood and can be readily specified, installed, operated and maintained.

Organizations, Associations, and Stakeholders Affected by the Manufacturing Partnership Initiative

This program, if successfully implemented, will have an effect across the market. Product manufacturers will be stimulated to produce and promote lower-cost, energy-efficient products. Associations of manufacturers, such as ARI (Air-conditioning and Refrigeration Institute, CRMA (Commercial Refrigeration Manufacturer's Association), AHAM (Association of Home Appliance Manufacturers) and GAMA (Gas Appliance Manufacturer's Association) and others will be encouraged to develop test procedures, training materials, courses and ratings for the energy efficient products. The initiative will make it easier for distributors and dealers to sell high efficiency products by reducing their cost and providing ancillary materials and support to facilitate sales. Consumers and specifiers will be provided with cost effective, higher efficiency products and the information needed to select, install and operate this equipment. Organizations such as ASHRAE (American Society of Heating Refrigerating and Air Conditioning Engineers), and ACCA (Air Conditioning Contractors of America) that represent these market participants will play key roles in providing this information and monitoring its utilization. Utilities such as PG&E, SCE, and SDG&E will be able to satisfy their demand-side management objectives more readily as the array of cost effective, energy efficient products issues from this initiative.

As more energy efficient products are placed in the market, suppliers and service contractors will obtain more experience with the energy efficient choices, creating a stronger service sector for the energy efficient choices. These changes should occur in the entire market, and thereby affect all market participants and technology consumers. The result will be increased efficiency across the product stream. If successfully launched, many product lines should be impacted by this initiative. If successful, the impact of this initiative will grow in the market as other R&D organizations partner with the Energy Commission to further leverage this initiative.

These organizations could include the U.S. Department of Energy, other state energy R&D organizations such as NYSERDA (New York State Energy Research and Development Authority), FSEC (Florida Solar Energy Center) and ASERTTI (Association of State Energy Research and Technology Transfer Institutes) and its other members, as well as private R&D organizations such as EPRI and GTI.

The following tabulation identifies the key groups that are affected by this initiative and influence this initiative. A range of interests are involved in upstream product development, manufacturing and distribution activities that have implications for energy efficiency interventions.

ASSOCIATIONS – Industry groups and trade associations will need to support the technology transfer marketing efforts to encourage market penetration, and to encourage training of their constituents to adequately deploy new technologies.

CONTRACTORS AND SPECIFIERS –Contractors often select the product to be installed in a retrofit, major remodel situation. This initiative will provide an increased array of energy efficient product offerings from which the specifier can select to provide the most value to their client. They will also benefit from the information provided to assist in product selection and utilization. Upstream rebates and incentives should result in distribution efficiencies that translate into lower product costs.

DISTRIBUTORS –The distributors of any products developed with outside R&D funding or rebates provided to the manufacturer would have a lower cost due to the reduced cost of manufacturing and therefore should have a lower retail price. Furthermore, it is likely that technology transfer and promotional materials and activities would accompany these programs making it easier to sell these products.

MANUFACTURERS – Manufacturers will provide the R&D, personnel, infrastructure and knowledge that will be the backbone of this initiative. Manufacturers will be the focal point for distributing the technology transfer materials developed to overcome the adoption barriers of market participants. Manufacturers are expected to respond favorably to producing efficient, cost effective products in response to volume demands from combined purchasers.

NONRESIDENTIAL CUSTOMERS– Nonresidential customers will benefit from increased availability of energy efficient products and the information needed to make informed market decision and to use the product effectively. Upstream rebates and incentives should result in distribution efficiencies that translate into lower nonresidential customer costs.

RESIDENTIAL CUSTOMERS – Residential customers will benefit from increased availability of energy efficient products and the information needed to make informed market decision and to use the product effectively. Upstream rebates and incentives should result in distribution efficiencies that translate into lower residential customer costs.

STATE OF CALIFORNIA, Energy Commission (PIER) – The Energy Commission (in partnership perhaps with DOE, ASERTTI and other R&D funders) organizations would provide funding for R&D to provide or accelerate the development of new

energy efficiency products that would benefit their constituents. Targets of opportunity would be developed from the ongoing planning efforts of the PIER program with input from the other initiatives outlined in this report.

UTILITIES – Utilities provide funds to support PIER R&D efforts and serve on project advisory panels to manage the research. They provide incentives for energy efficient products and design services and technology transfer products and service to encourage the adoption of energy efficient technologies. Utilities are often logical partners in government and private sector purchasing initiatives. Utilities should be one of the best sources of product and performance information that can complement manufacturer promotion of energy efficient products.

Issues and Market Conditions that will Affect the Success of the Initiative

There are a number of issues and market conditions that will affect the success of this initiative. These include:

1. Finding strong manufacturing partners who are willing to work with the state is a considerable concern. Manufacturers are often wary of partnerships with organizations that may not have goals that are congruent with their own. Strong manufacturers with strong product development expertise and extensive distribution infrastructure often feel that they have enough resources and expertise to select product development targets and to finance these developments. Secondary and marginal manufacturers are more likely to be receptive to overtures to engage in cost-shared product development efforts with the state or with other R&D funders. These secondary players however, may not have the market clout to aggressively promote the products that are developed in these partnerships. The ideal situation is to find strong manufacturers seeking to develop energy efficient products to augment their conventional product line who look to the Energy Commission and others not just for money, but for access to the infrastructure inherent with partnering with energy efficiency advocates and the resulting marketing advantages and image enhancements that this will afford. These partnerships will not happen overnight and need to be nurtured by seeking strong companies and individuals that can effectively develop and promote new energy efficient products and to build trust with these organizations and people that will carry over into win-win situations. An interviewee suggested working with those strong manufacturers that want to work with you so that others will follow as success is achieved.

Manufacturers may see the state primarily as a regulator and as such may want to keep an arms length distance. Consistent behavior that shows the manufacturer that the state can be trusted to maintain confidentiality agreements and can act as a partner rather than as a regulator or overseer will be needed. Manufacturers need to perceive that working with the state will reduce the risks of energy efficient product development and enhance their opportunity for market success.

2. Timing is important. If manufacturers have just retooled to meet some regulatory hurdle they will be disinclined to retool to make their new product line obsolete. If, on the other hand, the manufacturer was approached before the redesign and retooling

the likelihood increases dramatically of interesting the manufacturer in creating an enhanced, more efficient product than would otherwise have been produced.

3. Rebate and incentive infrastructures are geared to the consumer and retail level. To make upstream incentives work smoothly, mechanisms will need to be put in place for the manufacturer to be able to document product sales as they occur. This may require some paperwork to be generated at the retail or consumer level and, if so, could result in higher programmatic cost than would occur for a comparable consumer rebate program.

4. The manufacturer's distribution chain needs to buy into the marketing and sales efforts for the energy efficient products that are developed and promoted. The distributors and dealers need to avail themselves of the ancillary information products provided to them as part of the marketing campaign and use them to overcome the market barriers of those specifiers and customers making product selection choices.

5. As the product becomes successful and sales grow, the distribution chain needs to moderate their natural desire to increase product prices to increase their profits and as such dampen demand and reduce sales momentum.

6. If the initiative is rapidly successful there may be a shortage of the energy efficient technologies and products in the market and an over-abundance of non-efficient choices, causing a price drop in the non-efficient choice, thereby potentially boosting their market demand, causing more of the lower cost items to be placed in the market.

7. As the energy efficient choices become more established in the market, parts and service for the inefficient choice may become a lower priority for stocking practices.

8. A coordinated effort will be required between all interest groups to make these efforts successful.

Key Barriers Associated with the Success of the Initiative

There are a number of barriers to deploying manufacturing partnerships and upstream interventions that increase the availability of cost effective energy efficient products. Some of these were discussed in the previous section and relate to:

- Finding strong manufacturing partners
- Choosing the correct timing
- Documenting product sales
- Buy-in to the marketing and sales efforts by the distribution chain
- Avoiding price gouging
- Shortages of the energy efficient technologies and products

Other barriers are principally related to reducing the risk of specifying and installing new, unfamiliar technology:

Lack of an educational system or network: This barrier is focused on the lack of an educational system or operational structure that can place energy efficient information into the hands of the decision makers. Interviewees point out that "people don't always know what is efficient and what to buy, they need to be educated about the fact that you can buy in a way that is energy efficient and environmentally friendly." Because the level of energy efficiency across different makes and models changes all the time as a normal course of the market operations, there needs to be a way that specifiers are kept up-to-date on what is efficient.

Lack of expert advice and information: This barrier is associated with the inability of specifiers to go to a credible information source and obtain the information they need to make an energy-efficient purchasing decision. While there are publications and sources to go to for car mileage information, and there are Energy Star related information sources, for a wide range of other energy consuming technologies, there is no central source of information that can be accessed to obtain the quality information and documentation on energy efficiency that is needed to support purchase decisions.

Lack of performance information and assurance of adequate operation: Most specifiers/consumers are naturally risk averse and will avoid selecting and installing products unless they are reasonably sure they will work.

Misinformation or lack of information in catalogs and vendor documentation: Similar to the previous barrier is the tendency of product suppliers to place their products in the best possible light to gain a competitive advantage and identify a product as being energy efficient. Or, more often, information about a product's efficiency is not included in the product information. This misinformation or lack of information provides a barrier to making the right purchasing choice. For example, new product catalogs may not yet be available.

First cost: Higher efficiency products will likely be more complex and therefore more costly to produce.

Strategies for Overcoming Marketing Barriers

- Efforts should be made to attract strong manufacturing partners by providing them with incentives to work with Intervention actors to develop lower priced, more efficient products for California
- Pace product development efforts to coincide with manufacturer product design and development efforts underway to address their cycle of new product development/
- Develop bookkeeping methodologies and procedures for accounting for product sales in order to determine the distribution of upstream incentives.

- Provide marketing materials to make it as easy as possible for the distribution chain to effectively execute a successful sales and marketing program for energy efficient products.
- Monitor market conditions to assess whether new popular products will be fairly priced and take corrective action to correct anomalies that are found. Use the clout of manufacturing partners to assure that this effort is effective.
- Anticipate the demand for new products by encouraging stocking of the distribution change. This will be accomplished as part of the aggressive marketing and sales program being addressed in this initiative
- Other strategic efforts focus principally on reducing the risk of specifying and installing new unfamiliar technology. These include:
- Provide energy efficiency information and distribute this information through existing manufacturer and trade ally networks to
- Provide a central source of information that can be accessed to obtain the quality information and documentation on energy efficiency that is needed to support purchase decisions.
- Provide case studies documenting successful design, installation and operation, in situations similar to that of the specifier/consumer, in order to provide the credible performance information needed to overcome the resistance to change.
- New product catalogs and directories need to be developed and distributed with accurate, unbiased information about product operation and efficiency.
- This initiative seeks to reduce the cost of manufacturing with R&D partnerships and upstream incentives and rebates to efficiently reduce the cost of new energy efficient technologies.

The following programmatic actions are needed to mobilize this effort.

Prioritize Technology Development Opportunities - Look at energy use and demand in California and ongoing efforts to reduce consumption and peak demand. Identify needed products and their desired characteristics. Set product development goals including desired timing based on this assessment.

Develop Manufacturer R&D Partnerships - Investigate the key manufacturing players and their possible roles in participating in this initiative. Focus one-on-one efforts with potential key partners and move forward to cement relationships and initiate these partnerships.

Upstream Incentives - Examine existing and past incentive programs and determine which end uses and product types are most amenable to upstream interventions that include rebates and other financial rewards.

Market Connections - Mobilize market connection efforts that follow the recommendations of the Information, Case Studies and Demonstrations initiative

Legislation or Policy Considerations that can Influence the Success of the Initiative

Infrastructure and policies exist to permit this initiative to move forward in California. What is needed is a concerted effort to focus more attention on upstream interventions. No specific legislative action is recommended.

Potential for the Initiative to Achieve Market Penetration or Participation

The potential for this initiative to achieve significant benefits over several years is significant. Past efforts have achieved some measure of success in “golden-carrot” programs, design competitions, and R&D partnerships. These upstream efforts can result in leaps forward as opposed to business as usual evolutionary changes occurring by emphasizing downstream market pull efforts. A significant fraction of end-use product types could be influenced by these programs.

The concept of upstream rebates and incentives offers the possibility of product cost reductions compared to consumer incentives or that could significantly increase energy efficient product penetration. Assuming that the programmatic costs of upstream incentives are similar in scope to their consumer counterpart then it appears likely that rebate levels could be lowered for the same programmatic effect. If mark-ups between the manufacturer and the purchaser are 1.5 then a rebate reduction of one-third should be possible for the same market effect. Conversely the same level of rebate applied upstream would reduce prices by 50 percent compared to the downstream rebate and should result in higher market penetration.

Energy Efficient Procurement and Procurement Support Initiative

Sector: Governmental and Non-profit

Trigger event: Bulk purchase opportunities

Intervention type: Voluntary. Could be mandatory for government agencies

This initiative focuses on governmental purchasing procedures and the systems associated with establishing energy efficient purchasing approaches, and the acquisition standards that are associated with energy efficient product specifications. These will be discussed separately, but are strongly linked. That is, while an energy efficient purchasing approach can be in place to acquire energy efficient technologies, it is the actual purchasing standards and specifications that typically drive the individual, product-associated contract awards. However, because these can be used in the market in different ways that are addressed later and we approach the discussion of these aspects separately.

The procurement and procurement support initiatives should be considered as a potential mandatory initiative in that is should be ordered to be delivered via legislation, preferably, but at the very least by executive order. However, executive orders, without funding, may have little impact in California. As a result, we recommend that this initiative be legislatively required with a funding source allocated to this effort. However, participation in the initiative should be voluntary.

There are no specific target events associated with this initiative in the way in which trigger events are typically thought about. However, procurement practices typically follow annual cycles within the jurisdictions that need to be considered in the implementation efforts.

Energy efficient procurement

This part of the initiative discusses the establishment of a statewide energy efficient procurement system in California. Energy efficient procurement is not new to California. In the late 1970s and early 1980s the State of California began procuring products with attention to the amount of energy they consumed. This effort continues today, but is not aggressively pursued on a statewide basis, nor are there strong promotional efforts that keep attention focused on this aspect. Likewise, there is a lack of expertise within the California purchasing community that allows for constant concentration on acquiring the most cost effective products.

California is fortunate in that it has already established purchasing regulations that allow state purchasing contracts to be used by all governmental jurisdictions and non-profit organizations. This condition essentially allows any government or non-profit organization to obtain products from competitively-bid state purchase

contracts. What this also means is that the foundation for large-scale energy efficient purchases already exists in California, it only has to be more effectively used to save energy. However, there is also a condition in California, as in most other states, in which the purchasing function is fragmented and distributed across a host of agencies.

There is no strong central purchasing function in California that covers all state agencies and organizations and their associated purchases. We are not suggesting that there should be, as this condition allows substantial freedom for agencies and organizations funded by tax dollars to acquire products they need. However, this fragmented purchasing environment also means that there are a host of state offices all doing the same thing; purchasing the products they need. According to interviewees, even different campuses within the university and college systems have their own purchasing staff that acquire products at the campus level. The same applies across many agencies, boards, and commissions. Likewise, there are thousands of local government agencies in California, most of which have purchasing staff or staff charged with the responsibility of obtaining the products needed to support their operations.

In California, all the market pieces are in place to launch an effective statewide Energy Efficient Procurement initiative. This initiative needs to start by bringing all the purchasing organizations, offices, and staff together into a single focused effort of modifying purchasing procedures to evaluate products and apply energy efficiency credits to the purchase of those technologies that reduce energy demand and save energy. Some offices are already doing this, but many are not because of a number of barriers (discussed below) that inhibit this kind of effort. The effort needs to be adequately structured, funded and placed in operation so that the state can capture the savings available through this approach. We do not suggest a specific design for this effort within this report, but suggest that the Energy Commission focus efforts to obtain initiative funding and design the program to be effective within California's distributed purchasing structure. The Energy Commission should consider the following program design considerations:

1. The program should be voluntary. The Energy Commission should not try to accomplish an initiative with mandatory participation. It is not needed and the resistance to a mandatory approach would be strong.

2. The initiative should have a strong central product assessment office that evaluates the energy efficiency of products that are purchased within the public and non-profit markets. This can be done within the Energy Commission or contracted out through other organizations that are already established to provide testing services. The responsibilities of this component are to produce bid-defensible product evaluations that are grounded in objective scientific analytical processes. Products that are already being evaluated by other organizations may not need to be evaluated by this function, but rather the procurement initiative can use the assessment of others if it is certified that the assessment approach is objective and provides reliable results.

3. The staff conducting assessments should be skilled scientific investigators who understand the physics and chemistry associated with the products and their ability to influence energy consumption.

4. The assessment should not be restricted to technologies that are directly connected to electrical or gas supplies, but should include any products that affect energy demand or consumption and for which there are alternative products that provide the same function but save energy in the process. For example, low temperature laundry detergents can save more energy than high-efficiency washing machines. It is important that all products that impact energy consumption be considered.

5. The initiative should have a strong sales force. Without a strong sales force that can bring the product testing results to the thousands of state and local government organizations that could use the information, the likely success of the initiative is questionable. The sales force should be structured to match the ability of the initiative to be formed and begin operations. As a result, the sales force will need to be phased in as procurement recommendations and specifications are developed. The initiative should establish a sales force that allows personnel visits and initiative presentations to at least the top 50 percent of the targeted state and local governments and the top 30 percent of the targeted non-profit organizations.

6. The initiative should have a statewide communications effort. The initiative will need to maintain communications relative to the changing products and analysis conducted, verified, and disseminated. Different approaches to information dissemination should be explored and multiple approaches used. E-newsletters, purchase alert e-grams, presentations and workshops should all be considered. Without strong communications across state and local governments and the non-profit sector, the effort will struggle.

7. Feedback is important. The program should be established to provide feedback to participating organizations so that they know how much energy they are saving by using the coordinated energy efficient purchasing approach.

8. Make it easy to participate. The initiative will need to employ tactics that are compatible with user needs and timelines, and be user friendly. The initiative should make it easy to incorporate purchasing specifications or to support policy decisions with the information developed through the initiative. These materials should be non-threatening from a technical perspective, from a legal bidding and contract award perspective, from an operational or systems perspective and from a political perspective.

9. Publicize success and case studies. The initiative should proclaim its successes within the purchasing community. When organizations save energy they should be recognized for their contributions. Coordinate success stories through the procurement community and the procurement associations and related support organizations.

10. Learn from others and from the past. The initiative is not new, but newly resurrected. During the design process, learn about others who have done this before in California and in other locations.

11. Obtain the support of the Governor's Office and key allies. Have an opening launch that is publicized with key technical and policy makers on board. Show California as wanting to become the national leader in this area. Obtain the visible support of key procurement professionals in California, such as DGS's Reta Hamilton, Waste Management Board's Mark Leary, Sunne Wright-Peak of Business Transportation and Housing, members of the Energy Commission's Energy Coordination Committee, members of the Green Building Action Plan team, and others key stakeholders and supporters.

12. Coordinate, design, and launch with the already established EPPT (Environmentally Preferable Purchasing) that now has 30 departments within the team structure.

13. Consider placing the implementation branch of the initiative within the procurement offices of the state rather than within the energy offices of the state.

This initiative will need careful planning and coordination and will need to be given a few years to prove itself. However, if this is effectively designed, launched and supported, the savings could be substantial.

Energy efficient purchasing standards and specifications

This part of the initiative description discusses the establishment of statewide purchasing standards and specifications that allow energy efficiency to be contract-award criteria, either by policy, or through the bid analysis process.

The bid process is a legal contracting process. It is grounded in objective public assessment and bidding supply contracts. Purchasing decisions are subject to challenges from losing bidders and procurement staff must be able to defend awards with solid objective selection criteria. It is not enough to read that something is energy efficient; you have to be able to prove it is efficient enough to justify a bid award. For this reason, it is critical that this initiative be founded on objective accurate product assessments. The assessment process must be transparent and the criteria for assessing energy efficiency must be solid. For this reason, the most important aspects of an energy efficient procurement initiative are the standards and specifications on which the bidding process is based. The initiative must be able to provide procurement standards and purchasing specifications that support bid decisions or policy guidance that points to a specific type and model of equipment or practice. However, if done well, the purchasing standards and product specifications that will come out of this initiative can be of value to any organization making similar purchases. While the initiative can be established by targeting the governmental and non-profit sectors, the resulting products of the initiative will likely also be adopted by private sector purchasing officials across the country. The potential "spillover" of savings from this type of program can be as much or more than the impacts captured in the target market.

Importance of Initiative to California's Energy Supplies

California has a large distributed network of state agencies and purchasing functions. In addition, the state has a large number of non-profit organizations headquartered or located within the state. More than any other state, California can benefit from a government and non-profit focused energy efficient procurement initiative. The demonstration that everyone must do his or her part to be energy wise has no greater relevance than in California. It is important for California government to take the lead in demonstrating the value and benefits of energy efficient procurement systems, processes and approaches.

Coordinating this Initiative with Other Interventions or Activities

The procurement initiative should be associated with only a few interventions or initiatives. These include:

- Other efficiency programs to make sure that the procurement initiative has the latest information on the technologies in demand and the participant's experiences with the incentivized technologies. The procurement initiative administrators should be able to learn from the incentive programs so that they are aware of the experiences in the market when product assessment and recommendations are made.
- Other initiatives involving the same products, to ensure the increased demand for higher efficiency items does not drive up prices.
- The initiative should be coordinated with selected industry representatives to take advantage of market initiatives from the private sector.

Organizations, Associations, and Stakeholders Affected by the Procurement Initiative

This program, if successfully implemented, will have an effect across the market. As product suppliers begin to see that energy efficiency is important to the award of supply contracts, these suppliers will focus more attention on bringing those products into the bid process rather than a set of products that are most likely to obtain an award if energy is not an assessment criteria. Product suppliers will be more attuned to energy efficiency in selecting the models they carry and service. Pressure will be placed on up-stream interest groups to design more efficient products so that their dealers can obtain more awards. As more energy efficient products are placed in the market to fit the changing bid process, suppliers and service contractors will obtain more experience with the energy efficient choices, creating a stronger service sector for the energy efficient choices. These changes will occur in the market, and thereby affect all interest groups and technology consumers. The result will be increased efficiency across the product stream. If successfully launched, there should be few product lines that influence energy use that are not impacted by this initiative. If successful, the impact of this initiative will

grow in the market as other states, local governments, non-profits and even the private sector adapt their purchasing standards and approaches.

The government procurement network has a strong association called the National Association of State Purchasing Officials (NASPO). This organization has embraced the concept of energy efficient procurement procedures and will most likely continue to do so. This organization also provides or supports training programs for procurement professionals. It may be advantageous for this initiative to team with NASPO to offer workshops at regional and national conferences that focus on this initiative and how to use the standards, specifications and processes developed in California.

Certainly this initiative will impact every purchasing official in the State of California that wishes to take part in the voluntary aspects of the effort. These individuals include the state government purchasing agents and managers, as well as their contracting staff that need to write supply contracts, bid documents and bid specifications. Likewise, the local governments that elect to join this effort will be impacted; and if adopted by private industry, their purchasing staff will also be impacted. This is the purpose of the initiative; however, this initiative may also complicate the procurement process for those people who are not using energy efficient purchasing approaches, but who elect to move in this direction (see associated barrier on this issue). For those who are using these approaches or for those who want to do a better job at this approach, this initiative should ease their burden by helping support their product analysis needs.

In addition to coordination with the organizations mentioned above, there are a number of groups that have direct or indirect interest in this initiative. These include:

ASSOCIATIONS – Industry groups and trade associations are already involved in "green" purchasing, including preferential purchasing of higher efficiency energy using equipment. BOMA, facilities managers associations, purchasing managers associations, schools and local government associations are all interested in procurement for a variety of budget and policy reasons.

CORPORATIONS – A number of large private-sector companies have strong environmental friendly purchasing programs. Some of these (e.g., prominent home improvement and office supply retailers) are also vendors of higher efficiency products.

MANUFACTURERS – Negotiate special pricing on large-volume sales of goods and equipment to large public and private-sector purchasers. Manufacturers have produced some special high efficiency items in response to volume demands from combined purchasers.

NON-RESIDENTIAL CUSTOMER – Within government agencies and firms, a number of individuals influence nonresidential product choice and purchasing policies. They range from the individual worker who buys items from local retailers with an organization credit card, to units supervisors who favor certain items or brands because of their non-energy operational characteristics (e.g., easy to replace or repair, commonly available, long-time vendor), to purchasing officers, to

purchasing department managers, to higher-level decision-makers in the organization. All can influence the purchasing process (which is generally highly diffused through out the organization and much more flexible than might be imagined). Even lower level individuals can effectively veto green purchasing goals and policies. Innovative purchasing officials and others in organizations have been instrumental in changing practices in a number of cases, however, and they are members of networks of procurement professionals that cross organizational lines and the public/private sector boundary.

RESIDENTIAL CUSTOMERS – Residential customers look to government and others for recommendations on what they should buy and the energy and non-energy impacts associated with their purchase decisions.

UTILITIES – Utilities are also large purchasers and influence the purchasing of others thorough their energy efficiency programs. Utilities are often logical partners in government and private sector purchasing initiatives. Utilities are considered to be one of the best sources of product and performance information that can inform procurement decisions.

The market actor network diagram for this initiative is shown in Figure 11 below:

Figure 11. Market Actor Network Diagram for Purchasing Initiative

Market Conditions that will Affect the Success of the Initiative

There are a number of market conditions that will affect the success of this initiative. These include:

1. The risk that the initiative will be seen as a move by the central executive branch of state government as an attempt to influence the procurement process of the state government agencies to which this might apply. It will be important to place

this initiative into the market in a non-threatening way that employees a voluntary participation approach.

2. Procurement staff may not like outside organizations attempting to tell them how to purchase the items that they have been successfully procuring for many years. Again, it will be important to offer the services to those that want to take part and rely on the sales force and networking to build voluntary participation.

3. If the initiative is rapidly successful there may be a shortage of the energy efficient technologies and products in the market and an over-abundance of non-efficient choices, causing a price drop in the non-efficient choice, thereby potentially boosting their market demand, causing more of the lower cost items to be placed in the market.

4. Vendors will need to adjust their product mix to maintain more stock of the energy efficient choice, this will percolate up through the supply change causing manufacturers, dealers, and distributors to change their market mix.

5. As the energy efficient choices become more established in the market, parts and service for the inefficient choice may become a lower priority for stocking practices. (This is what happened in Wisconsin when over 90 percent of the market went to incentivized high-efficiency furnaces. Dealers reacted by stocking the high-efficiency products and special ordering more of the inefficient products and their associated parts.)

6. There may be a mix in the regional or national distribution of energy consuming product models. Distributors may elect to send the high-efficiency stock to California where it will be more readily sold and send the lower efficiency stock to other states with lower demand, such as Texas.

Key Barriers Associated with the Success of the Initiative and Strategies for Overcoming these Barriers

There are a number of barriers to having a statewide coordinated open-access energy efficient procurement initiative that the program design will need to address. These include:

1. Lack of an educational system or network: Interviewees point out that “people don’t always know what is efficient and what to buy, they need to be educated about the fact that you can buy in a way that is energy efficient and environmentally friendly.” Because the level of energy efficiency across different makes and models changes all the time as a normal course of the market operations, there needs to be a way that purchasing officials are kept up-to-date on what is efficient.

2. Lack of expert advice and information: This barrier is associated with the inability of purchasing officials to go to a credible information source and obtain the information they need to make a energy-efficient purchasing decision. While there are publications and sources to go to for car mileage information, and there are Energy Star related information sources, for a wide range of other energy consuming technologies there is no central source of information that can be accessed to obtain

quality information on energy efficiency that is needed to support purchase decisions. The energy efficiency program environment is not structured to advise purchasing officials who need comparative information on which a decision can be based. While AB-495 requires the state to develop an environmentally friendly purchasing manual to inform purchasing decisions, there is no easy way to get the information to support these decisions.

3. Lack of people with expertise: Energy efficiency assessment is typically not a critical part of the qualifications needed for procurement managers or purchasing agents. Few people within the procurement function have energy efficiency and energy-related technical expertise. There is a need to educate the purchasing professionals about the science and assessment techniques associated with energy efficient procurement practices. While several procurement professionals within the state, university, and larger city procurement systems are very knowledgeable about energy analysis techniques and the importance of energy efficiency, it is not a standard set of knowledge embedded at all levels of purchasing officials. Likewise, most purchasing offices, including the state, university and larger city procurement offices, do not have staff charged with the responsibility of acquiring energy efficiency information on the technologies they purchase. There is a lack of skilled, trained professionals within the purchasing systems to focus on this issue.

4. Misinformation or lack of information in catalogs and vendor documentation: Similar to the previous barrier is the tendency of product suppliers to place their products in the best possible light to gain a competitive advantage and identify a product as being energy efficient. Or, more often, information about a product's efficiency is not included in the product information. This misinformation or lack of information provides a barrier to making the right purchasing choice.

5. Efficiency knowledge at the product level: To make energy efficient purchasing awards, the purchasing official or decision maker must have the information to know how to assess the energy savings for each product being bid. This requires expert knowledge that is capable of withstanding an award challenge. It is one thing to think a product or approach is more efficient, it is another to award a contract based on an undocumented assumption or an opinion. Purchasing decisions need to be based on a foundation of strong documentation that is capable of withstanding a legal challenge. This means that purchasing officials need very high quality energy efficiency information at the specific product and model level. While it is a standard approach to let the vendors submit this data with their bid, this does not mean that the data submitted is accurate. Purchasing officials need to be able to confirm a bidder's claim regarding energy efficiency.

6. Increases the cost and complexity of the acquisition process: The process of procurement is an organizational support function. Typically, procurement is not a revenue generating operation; however, it does have the ability to lower costs through lower-priced, higher-volume competitive acquisitions. Nevertheless, the purchasing process needs to be fast and efficient. It has to acquire products within the timelines needed by the product users and it cannot add substantial costs to the acquisition process that are not recovered through price savings. Energy efficient procurement adds another relatively complex process to what would otherwise be a

standard acquisition process. Adding costs to operational support functions is not something favored by upper management and executives. As a result, the process of establishing energy efficient procurement practices across the state can be challenging. Initiatives must not add costs, but instead add benefits that can be employed to help everyone.

7. Information that is too late to use or too early to be accurate: Each organization that has a formalized procurement process has procurement schedules, many of which are annual schedules. The information needed to make energy efficient bid evaluations and procurement decisions needs to be in the hands of the users at the right time, and it needs to be accurate for that bid period. Information that is available after the bid is of little use until the next bid cycle. Information that is available before the bid process can be used for the bid documents, however it must be accurate at the time products are purchased. That means that last year's information on models that are not offered in the following bid cycle is of little value to the procurement process.

8. Adequate supply of product: When volume pricing is requested for an energy efficient technology that does not mean that the bidders can actually provide the product in the volumes needed. Suppliers of products must be able to obtain enough product through their supplier networks to fill the demand. As volume purchasing increases to obtain a lower price, the bidders must be able to increase their supplies to meet the demand. However, in many cases the bidder is not the product provider, but instead is the retailer who has to go to their providers to obtain the product to meet their bid obligations. If their suppliers cannot meet the demand via their supply chains, or their providers decide not to meet the demand because it would leave other customers without product, the demand can remain unfilled. This forces customers to acquire the product via other, typically more expensive, market channels.

9. Vendor availability: This barrier is similar to supply availability, but is focused on the vendor population. In some cases there are not enough vendors of the energy efficient technologies to acquire competitive bids that are the key driver for lower costs. Vendor availability is a technology-level consideration. An assessment will need to be made on a product-by-product basis concerning the vendors in the market that are capable of bidding and supplying energy efficient products in a volume bid environment.

10. Fist cost: This common barrier was identified in the literature and by the interviewed experts, however, it is not thought to be a significant barrier for many of the purchasing jurisdictions that practiced life-cycle-costing in the late 1970s and early 1980s. While this is a significant barrier for some jurisdictions on some types of items, "…Most jurisdictions are familiar with the concept of life-cycle-costing, in which the smart move is to buy the product that is the least expensive to own over the life of the product." This comment suggests that while some jurisdictions may focus on least first cost for some products that meet quality standards, a statewide initiative will find that most purchasing officials and decision makers will already be familiar with a key component of energy efficient procurement practices, even the

ones that now value first cost as the primary purchase criteria. However, some jurisdictions will need to be convinced that the energy efficient approach is better.

11. Cost of higher-level energy efficiency: This barrier was identified to point out that there are levels of energy efficiency, and that if jurisdictions stay in the high, but not the highest, energy efficiency levels, there will be fewer issues with cost. However, this interviewee pointed out that once you get into the highest efficiency technologies then cost does become an issue.

12. Turf issues: Some procurement professionals would interpret a statewide procurement effort as imposing on their purchasing turf, limiting the success of such an effort. However, the number of individuals taking this position would be smaller each year as user networks communicated the success of the approach and the lack of risk when handled objectively. This effort might difficulty in the first few years, but if designed and managed objectively and efficiently, the initiative would gather momentum and support.

13. Mistrust: This barrier was identified by interviewees as mistrust across governmental jurisdictions that would impede cooperative relationships.

Strategies for Overcoming These Barriers

There are a number of proven operational approaches for overcoming these barriers and implementing successful intervention strategies. These include:

1. Use current professional organizations to leverage and launch the development of a California network of energy efficient procurement professionals or build on one or more of the current organization/associations to establish an educational network specifically supporting this initiative. Most of these organizations are already familiar with the ideas associated with energy efficient procurement and will be receptive to these efforts. Some of these organizations have already established training programs of this nature within their organizations. This educational effort does not need to start from ground zero, but is a matter of organizing and using what is already there and supplementing current structures with initiative-focused structures. Current organizations that would be expected to support this educational and training network include:

a. The National Association of State Procurement Officials,

b. California Association of Public Purchasing Officials,

c. California Association of School Business Officials,

d. California County Superintendents Educational Services Association,

e. National Contract Management Association,

f. National Institute of Governmental Purchasing,

g. National Association of Counties,

h. Public Housing Authorities Directors Association,

i. Government Finance Officers Association,

j. International Federation of Purchasing and Materials Management,

2. Use the educational and training network established above to develop and train purchasing officials. Make the training high quality, inexpensive, and easy to attend. Build on the expertise that is already there. Use current and past programs as examples and provide case studies and clear examples.

3. Identify local and national experts to kick-off and start the educational and training efforts. Look for people with scientific and analytical assessment skills to guide the effort and support the training with initiative funding.

4. Prioritize the technologies to consider so that energy impacts are maximized. Prioritize at the state and local government levels as well as the non-profit levels, so that the initiative is rapidly effective. Focus on energy savings and improving the environment.

5. Use successful approaches that have been tried by others to demonstrate that energy efficient purchasing is not overly risky or technically challenging. Have the initiative provide documents that help new users thorough the bid, assessment and award process. Demonstrate how challenges to awards can be successfully handled. Demonstrate how a routinized approach, with information support from the initiative and others, can minimize costs and risks and can build on current knowledge and expertise.

6. Team with key organizations and procurement officials to understand bid cycles in California and tailor assessments to these cycles, allowing time for information dissemination and use prior to the bid cycles.

7. Make sure product assessments are grounded on objective, reliable assessment approaches. Have the data that demonstrates energy savings. Make sure product or assessment approaches include reliability assessments of the savings and of the performance of the technologies. Make sure vendors can back up product performance with guarantees.

8. Make sure the information about products is based on scientific assessment and not anecdotal or vendor claims. Keep the quality of the technical information strong. Consider using organizations already established that can take on this roll, or build expertise that is initiative-specific in California. Both approaches have cost and benefit trade offs.

9. Works with initiative participants, industry representatives and others to structure the bidding process so that is does not over-impact the market. Structure the initiative so that demand is not stretched to the point where energy efficient and cost effective procurements become unavailable because of increasing demand. Works with vendors to make sure they can deliver on promised bids, have them show proof of supply ability and relationships. Move failures into the communication networks so that users know that they may need to back off of a bid for a year until the market catches up. Works with California's energy acquisition, demand reduction and energy procurement programs to not overly stress the market and cause equipment bottlenecks in the portfolio supply chain.

10. Do not shipment of more energy efficient products to California as a negative effect. Instead view this effect as positive and promote it. Establish this as a goal and let the market react as more states adopt the practice.

11. Establish a central assessment office with a procurement operation or such that very close ties are established within the procurement function. Procurement professionals will listen to other procurement professionals more than they will listen to non-procurement professionals.

12. Make participation voluntary and let the networking of success and case studies support the growth of initiative participation. Establish an effective sales force that does show-and-tell demonstrations within the target markets and rely on these presentations and resulting networking effects to grow voluntary participation. Publicize those that accomplish results, provide awards and recognition. Provide feedback on the amount of energy saved by participants.

13. Plan for the long-term and allow the initiative to organize and mature and become established in the market. Allow travel and technology transfer to occur to spread the initiative in California and beyond.

These efforts will substantially reduce the barriers identified above and if effectively implemented will allow the initiative to succeed and grow in its impacts.

Market Conditions that Support the Initiative

In addition, there are a number of market conditions that were identified during the research effort that may support the operations of this initiative. These include:

1. Volume pricing: Interviewees suggested that volume pricing is a powerful tool for bringing down the price of energy efficient technologies and related systems. Interviewees identified cases in which their purchase price for the energy efficient technology was obtained at prices lower than the energy inefficient choice when they could buy in enough volume to lower the price. This is the basic principle for centralized purchasing departments in most government and corporate settings. By buying in volume, the energy efficient choice can be cheaper than the inefficient choice.

2. Product price: Interviewees suggested that the energy efficient choice is not always more expensive on a per-item basis and when other factors are considered the energy efficient choice can be significantly lower in cost. Markets are not static and prices change daily across products and services. When procurement officials keep up with product configurations and price changes, it is often possible to purchase a more efficient product at a price that is equal to or in some cases less than the inefficient choice. Likewise, there are products that may cost more at the point of purchase, but provide substantial savings in other areas. Interviewees indicated that flat-panel computer screens (LCDs) are more expensive, but save space on the desktop typically worth from $15 to $30 per square foot per year. In addition, they save more in energy costs than what is needed for the increased price, and they are less environmentally damaging at disposal.

3. Voluntary purchasing consolidation: Interviewees speculated that by aggregating technology needs and purchase contracts across California on a voluntary basis, it may be possible to lower the cost of energy efficient and environmentally friendly purchasing. One way to accomplish this is to expand and promote the joint purchasing ability of the State of California. According to interviewees, the state now has a joint purchasing agreement that allows public jurisdictions and non-profits to acquire products directly off state-bid contracts. This mechanism can be used (and is used) to acquire energy consuming technologies. However, this mechanism could be put to better use and promoted as a tool to save energy, save money, and improve the environment.

4. Cross-state procurement contracts: At this time, California is considering the issues of cross-state purchasing contracts in which multiple state and local jurisdictions could group together to obtain added purchasing power and thereby obtain better pricing. This system, if successful, could also identify products that best improve the environment and save energy at the same time. In this system each participating organization would have full choice in their acquisitions, but together the purchasing power would be substantial.

5. The Governor wants action and results: Interviewees indicated that the current Governor is motivated by action and results and wants to see systems put in place that work and provide value to the people of California. This type of an initiative, whose concept is already supported by the Governor's Office, would demonstrate action and results if carefully managed.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Interviewees suggested that both policy changes and legislation should be enacted to help move this initiative forward. It was suggested that legislation focusing attention on the need for energy efficient procurement be developed. Also suggested was that state governments be required to implement such an approach in all key purchasing environments. Other suggestions include:

1. Establishing an executive order that specifies energy efficient procurement approaches for the offices under the Governor.

2. Legislation should be passed that focuses on this specific initiative. Interviewees suggested that the way in which past legislation has been passed regarding California's energy and environmental future may not be specific enough to have a substantial impact within the purchasing arena. Bill 8498 addresses energy efficiency, but is not specific enough to significantly influence energy efficient procurement practices.

3. Legislation would help establish a stronger focus on this initiative. An interviewee suggested there is no strong focus on this issue and that new legislation was needed

4. Legislation requiring state government participation was suggested. This interviewee noted that if you want government participation you have to require it.

Potential for the Initiative to Achieve Market Penetration or Participation

The potential for this initiative to achieve significant participation over several years is significant. Interviewees agreed that this would be a service that would have good initial demand which would grow. Interviewees indicated that they have already been approached by local governments looking for this type of help. “The demand is there. Big cities would take advantage of this as they are already on board with these types of goals. I have had several major cities come to us for this type of service. The smaller cities will come on as they see the benefits. School districts will be the same way and CHIPs will follow. The Collaborative for High Performance Schools would want to follow this.” These comments suggest that over time, the majority of government agencies would use this service for some of their purchase decisions. Likewise, if the service is promoted to non-profit organizations via the sales force, they too will adopt the approach, although perhaps not as fast or as completely, because of the need to watch first costs. It would not be surprising if 30 percent to 50 percent of the energy consuming product purchasing in California’s state and local government markets would be influenced by this initiative if properly designed, funded and managed.

Energy Efficient Branding Initiative

Sector; Residential and Commercial

Trigger events: Several dealing with product specifying and choice decisions

Intervention type: Voluntary

This initiative focuses on the use of energy efficient technology or technology-service branding and its potential to capture additional energy savings in the residential and nonresidential sectors.

There is considerable interest in the use of branding and co-branding to capture additional market share for energy efficiency programs. However, there is also considerable entrenchment in the management practices of the current brands such that they may not reflect the most efficient product choices or cover all of the technologies and services needed in California. Furthermore there are significant brand protection interests within the current brands, limiting how they can be used. Yet, there is a need for energy efficiency branding initiatives to focus on the more efficient products and services and not recognize some of the lower performance levels that are currently being recognized through the Energy Star brand. One of the drawbacks of the Energy Star brand is that it does not recognize the most efficient products in the market if the program considers the providers of that product to be too small to create effective competition, essentially holding back the placement of high-efficiency products from Energy Star recognition. Energy Star is considered by some managers to be slow to adopt new products under the brand and may not

withdraw the brand fast enough when there are more efficient choices available. Thus, while the Energy Star brand is an indicator of higher efficiency levels, the Energy Star initiative incorporates characteristics into the management of the brand that limit or complicates its use as an effective tool for California's programs. As a result, the AB-549 research has identified the need to consider a more effective branding approach in California to replace or supplement the Energy Star brand.

Currently organizations and programs are managing these drawbacks to the Energy Star brand via co-branding approaches or through the CEE's 2-tier approach, in which Energy Star products are placed in a lower efficiency, tier-1 status or a higher efficiency tier-2, depending on their level of performance. These co-branding and split-branding efforts further compound the confusion in the market about what Energy Star really means. NYSERDA is one state that has taken a co-branding approach, although the approach may be one of creating a consistent market message with other Energy $mart programs more than it is a strategy for increasing energy savings. With CEE having moved to the 2-tier Energy Star approach and NYSERDA moving to a co-branding approach, there is the potential for the Energy Star brand to be considered a secondary decision criterion, or run the risk of being associated with branding that does not go far enough.

This is the position in which California finds itself. That is, there is a recognition that promoting the Energy Star brand may not be the best branding approach if the goal is maximizing energy efficiency. The question becomes: should California move beyond Energy Star and establish its own brand and have California programs incentivize or market only the new brand, or should California co-brand with Energy Star and only co-brand the products that are the most energy efficient, essentially maintaining a double-labeled 2-tiered approach? Or should California use only the Energy Star brand as currently configured and realize that the brand may not provide the desired effects?

This decision has national implications. If the largest state in the nation, with its massive market pull, moves away from Energy Star, the brand will suffer in the market and its value as a label will be significantly lessened. Yet using the Energy Star brand means that there could be confusion in the market about what Energy Star means if a two tiered co-branding approach is put forward.

In addition to these considerations, there is the problem of moving new products and product configurations into the Energy Star brand if California elects to stay with that brand. If California builds a new brand, for example, the California Energy Commission brand, then California will have control over the products classified under that brand and can move products under the brand as desired. Likewise, California would be free to create its own approach for providing brand awareness and for setting brand standards. California could move into concepts such as the Energy Commission-certified kitchen, the Energy Commission -energy certified home or building, and it would be free to have Energy Commission -certified plug load appliances or to set branding relationships with home inspections, building commissioning professionals or other technology-service combinations. California could streamline the process for homes or buildings becoming Energy Commission -Energy Certified, and create partnerships that allow home rater-contractor

relationships to move Energy Commission energy rated homes into the market at a premium to other homes.

The benefits of a California brand are many. However, branding is very expensive and time consuming. Energy Star took years to become a brand now recognized by 60 percent of the residential market. Likewise, the federal government spends tens – of millions of dollars annually to build and maintain the Energy Star brand. Moving a new energy brand into the marketplace will take time and significant funding, draw funding away from other initiatives, and send mixed marketing messages about what the Energy Star brand means and what competing or complementary branding means. California brand awareness to impact customer purchase decisions would need to be built from the ground up. Tens of millions of dollars a year would need to be applied to support product assessment approaches and to building brand awareness across the consumer population at the same time that Energy Star continues to do the same thing. Since it would not be possible to push the Energy Star brand out of the state, a co-branding approach would be the logical default position if a California brand were to be established. If California wanted to incentivize only the most efficient products it would need to incentivize only the California brand or develop a 2-tier approach. The 2-tier approach would be least expensive compared to establishing a new brand because it builds on the CEE's approach and builds on the Energy Star brand.

Likewise, manufacturers will most likely resist efforts for individual states to move toward multiple branding approaches, as product testing and labeling is expensive. Yet, California makes up one of the largest economies in the United States and changes in California would most likely influence the branding and product purchasing characteristics of at least the western half of the United States. Likewise, if the California brand were seen as more efficient than Energy Star, users of the Energy Star brand would see benefits in moving to the California brand. From this perspective building a new, more energy efficient brand for California has great appeal. This brand could be used to co-brand when it is linked with an Energy Star product, especially a tier-2 product, and it could be used to move into new branding areas that Energy Star is slow to adopt. In essence, a co-branding approach similar to that being used in New York, can provide California with the best of both approaches without harming the Energy Star brand beyond some level of brand confusion within the co-branding market. Essentially, California could establish its own brand and use that brand for California Incentives, and allow the Energy Star brand. This would essentially place the Energy Star brand in a supporting role in California. California could then support the Energy Star brand by labeling the higher efficiency products. This essentially is what the CEE 2-tier or the NYSERDA co-branding approach does. This approach also allows California and states like New York to establish brands beyond the Energy Star label. New York may be interested in having the Energy $mart brand become entrenched in California so that a whole new brand is not established. If the two largest economies in the United States, one in the east and one in the west, were to adopt the same brand, other brands such as Energy Star would need to follow or face losing market recognition as a valued brand name. Energy Star would at least be more pressured to keep up with the

latest in high efficiency products and move into new technology and technology-service areas.

With all this said, the issue becomes one of deciding what to do in California. Should California move to its own brand or maintain a 2-tiered approach, or should it stay with incentivizing specific model types that are covered under the Energy Star brand? A key factor in this choice is the question of where California wants to be in ten years, and if California can work with Energy Star to have Energy Star respond to California's needs for increased energy efficiency from the brand.

At this time it is premature to make a decision on these issues. California needs to launch into additional negotiations with the Energy Star brand to see if the brand is willing to work with key states to move the brand into higher efficiency levels and the new uses and brand acquisition procedures that California needs. We expect that if the states of New York and California and other public benefits states were to begin negotiations about a different brand, this would pressure the Energy Star brand to be responsive to state needs. But this is not certain. What is known is that if California moves to its own brand it will be expensive. A co-branding approach like NYSERDA's will be somewhat less expensive. Using the Energy Star brand will be the least expensive approach, with or without a 2-tiered approach. In the end, this decision rests with the policy makers in California who have to cover the costs for as long as the brand is to serve its function. A long-term perspective should drive this decision, as branding awareness does not happen in a few years, even with large budgets for market connections and publicity. This alone may have a devastating effect on California's programs unless new funds are found to build the brand. The least risky approach, albeit the one with lowest potential benefits to California, may be to stay the course and only incentivize Energy Star models that are approved by the policy makers so that the energy goals are met.

Trigger Events for the Branding initiative

Regardless of the approach adopted in California, there are several specific trigger events associated with when energy efficient-branded equipment is purchased. Following are the top twelve trigger points where branding can provide positive returns:

1. Remodeling and updating homes or buildings.

2. Tenant turnover: When tenants move out of the building, leaving it for the owner to consider upgrades to attract new tenants. This is different that the tenant request (below).

3. Leasing or renting a home or building: When a building is being inspected by a potential renter or lessee. The new tenant can request upgraded appliances as a condition of signing the lease or rental agreement.

4. Replacement of failed equipment: When a product fails and is in need of replacement, at which time the energy efficient choice can be selected.

5. First time new appliance purchase: When a consumer purchases the product for the first time, interacting with sales staff and choosing the models to buy.

6. New residential and nonresidential construction: When a new building is being constructed and the contractor or the owner must choose which equipment to have in their building.

7. Buying or building a home: During the purchase transaction when customers may be receptive to changing out energy inefficient products. This can be during the home inspection or during the financial arrangement periods.

8. Home energy ratings or audits: When a home is being rated or audited, such as in a HERS rating, or one of the three types of energy audits provided in California (in-home, mail, or web).

9. Building commissioning: When a nonresidential building is being commissioned and the commissioning agent has an opportunity to advise the owner/manager on brand-rated equipment.

10. Requests for Energy Star or other branding certification: When a building owner or manager is requesting that their structure be Energy Star rated and is receptive to recommendations for branded equipment change outs.

11. Participation in other initiatives: When a customer participates in any one of the energy efficiency, procurement or demand reduction programs and can be provided with recommendations or made aware of branded equipment and its benefits. This includes being a recipient of information or educational effort via any one of California's information and education programs.

12. Code updates: When codes are updated and the new codes can incorporate the use of branded equipment performance specifications or name tags.

Each of these trigger points provides an opportunity to inform customers about the ability and benefits associated with branded equipment. Currently, California's programs that promote the Energy Star brand attempt to get purchase advice into the market so that customers can make informed decisions that save energy and improve the environment. However, there would need to be specific initiatives implemented to place this information in the decision maker's information stream at these key trigger points.

Importance of Initiative to California's Energy Supplies

There is already an energy brand in California that is used to capture savings. However, there is interest in moving more products under the brand and in establishing branded services and service systems. Concepts like the Energy Star Kitchen, Energy Star Commissioning, Energy Star O&M Practices, Energy Star small kitchen appliances and a wider selection of plug load equipment are a few of these considerations. In addition, there is a need to make energy efficient building certification an easier process that can be accomplished with a single phone call to service providers who handle the extensive analysis and submission processes. And there is a need to move some of the less efficient Energy Star branded equipment off the Energy Star label, and a need to move new energy efficient products on to the label, even if they are manufactured by only one or two companies. Finally there is a need to streamline the pace of the Energy Star labeling process.

None or very few of these things can be achieved through the Energy Star brand that is controlled by organizations beyond California's borders. If these accomplishments are to be achieved they will have to be achieved by working with the Energy Star brand or by co-branding, or by creating a new California Energy Certification approach. The savings of moving the energy efficient market to more energy efficient products via a new brand, by co-branding or by maintaining a 2 or 3-tiered approach are substantial.

Coordinating this Initiative with Other Interventions or Activities

The branding initiative should be coordinated with several interventions and program initiatives. These include programs that work with, coordinate with or are involved with:

- Energy Commission and CPUC staff and officials who must make the policy decisions on branding and who must provide and oversee funding systems.
- Manufacturers, distributors, dealers, and retailers who provide and sell the branded products.
- Energy Star and CEE administrators and managers, would likely prefer partnerships with California rather than deal with creation of a new competing brand. They may therefore be willing to change their present approach in order to discourage new brands.
- Marketing and branding promotion and awareness experts, who must be able to place the brand in the market, make it work and protect its image.
- Utilities who offer programs that would need to use the brand.
- Third party program providers who would need to use the brand.

In addition to coordination with organizations, there are a number of groups that would have direct or indirect interest in this initiative. These include:

ASSOCIATIONS – Industry associations and trade groups provide information on best practices and new products to their members and other industry members. They also represent their members' interests in legislative and regulatory contexts when product standards are under discussion. In these ways they serve as both diffusers and blockers of innovation.

BUILDING COMMISSIONING AGENTS AND SYSTEM ASSESSMENT ANALYSTS - Building commissioners and systems assessment analysts need to be able to know what technologies are available to help solve building energy problems and to commission buildings so that they perform well. This group has an interest in staying current in what is and is not brand rated.

BUILDING PROFESSIONALS – Architects and building engineers need to know what equipment to use. Current branding approaches exclude much of the larger energy consuming equipment found in commercial and industrial buildings. This market also needs simple ways of specifying technologies that meet code and save energy.

CODE OFFICIALS AND ASSOCIATED CODE ANALYSTS - Code officials and code assessment support analysts have an interest in staying current on branded technologies. This interest will grow as branding enters more commercial building size equipment.

CONSUMERS – Brands provide consumers with shorthand information about product characteristics and quality. Brands were originally developed as marketing strategies to differentiate otherwise unremarkable commodities (e.g., soap or bacon). Subsequently, brands have come to be associated with innovative products, durable products, high quality products, and products intended for elite consumption styles. In some cases, just the fact that a particular company name (which is often synonymous with the brand) is affixed to a product is taken as an indicator that the product will necessarily have all of the features and qualities one might want—including features that the consumer did not know they wanted. In the energy arena, consumers view the EPA/DOE Energy Star brand favorably—30 percent of U.S. households have purchased an Energy Star product, and have been happy with it. One observer noted that, in addition to signaling efficiency, this brand is associated with "doing the right thing for some higher good." In essence, the very idea of efficiency gains credibility from its association with the Energy Star brand.

CONTRACTORS – Contractors will recommend and install specific branded products, typically within the lines of the products they carry. Contractors favor certain brands over others, and in some cases are closely connected (e.g., through exclusive commercial relationships, as in HVAC servicing) with particular vendors and their brands. These connections can be legally binding and restrictive to other brands. Some contractors also act as retailers, buying branded items in bulk and reselling to their residential and commercial customers. It has been noted that the contractor is most often the person who "makes the sale," and this can be a process in which branding plays a significant part.

ENERGY EFFICIENCY SERVICE PROVIDERS – The infrastructure for "branded services" such as "Home Performance with Energy Star" (whole house diagnostic testing and retrofit) is very limited. Technical training and specialized equipment are required and have yet to be widely adopted by energy auditors and contractors. The situation is very different for "branded products" such as Energy Star computers or appliances, which are widely available through a variety of distribution channels.

ENERGY INSPECTORS, RATERS AND AUDITORS – This group of professionals needs simple ways to determine what is and is not efficient and need to know what changes to recommend in their audits and ratings. These professionals need to provide trusted information to consumers about the efficiency characteristics of branded products.

LOCAL AUTHORITIES – Trusted sources of information and referral to sources of high efficiency branded products and services. Because of their roles as consumers of energy-using equipment, they are also likely partners in promoting high efficiency brands. They may actually have greater familiarity with and trust in innovative technology than businesses in local communities.

MANUFACTURERS, DISTRIBUTORS, DEALERS – The manufacturers, distributors and dealers in addition to being involved in the development of the branding approach would need to supply the products under that brand. A number of large manufacturers are already involved with the Energy Star brand and feature that label on their products next to their own brands. They can and do alter product designs and operating characteristics to secure rights to the Energy Star brand and may do so for a California brand. Manufacturers sell through a distributor/dealer network. Brand differentiation makes it easier to sell the branded product. Since the manufacturing and distribution chains make margins on each sale, it is normally in their interest to move whatever is easiest to sell.

Distributors are often the key link between retail demand and manufacturing, ordering goods, distributing surplus production, and managing cooperative advertising programs. One observer noted that those in the supply channel (distributors and resellers) "… [are] the ones that invest in taking the brand to the consumer at the point of sale." They also noted that many individuals in the distribution system sometimes decide to "take up a brand," although this is probably more likely for a "public brand" such as Energy Star, since many distribution relationships are exclusive, preventing vendors from carrying competing brands. However, when sets of trade allies do decide "…to pick up the brand … they will spend their money to promote the brand … because they are marketing their [own] product."

MANAGERS AND OWNERS OF LEASED AND RENTED PROPERTIES - Managers and owners of leased and rented buildings need to know what equipment to put in their properties, especially when they pay the utility bills.

NONRESIDENTIAL CONSUMERS – Commercial building owners and tenant firms are customers for both high efficiency and customary products. Energy Star office equipment and appliances are commonly purchased by businesses and government agencies for use in commercial settings. There is reason to believe that a number of these consumers, as in the case of residential consumers, "want to do the right thing." A number of building owners have taken advantage of opportunities to benchmark their buildings using the EPA/DOE database to qualify for an Energy Star Commercial Buildings designation as a high-performing facility.

PROGRAM PARTICIPANTS - Program participants in most of California's programs dealing with a potentially brand-covered technologies and practices need to understand what is and is not brand-rated and how the technology is related to program services and incentive levels.

REALTORS AND LENDERS - Realtors and lenders may need to work with inspectors or certifiers to arrange equipment upgrades prior to a sale, especially if home or building energy audits become a requirement in California.

REMODELING AND RENOVATION DESIGNERS - These professionals will typically specify equipment in their designs and specifications and need to know what items are and are not energy savers.

RETAILERS – Retailers sell the majority of appliances, lighting and electronics to residential customers and a large share of commercial and government purchasers. Retailers are a primary source of information on branded items and they are often deeply invested in particular brands. Of all of the representatives in this arena, they are the closest to the consumers and they typically "close the deal."

STATE OF CALIFORNIA – The State is also a large consumer of branded goods and has supported both Energy Star and California equipment brands through Energy Commission and CPUC programs, including delivery of information and incentives.

UTILITIES AND THIRD PARTY PROVIDERS – These groups have promoted Energy Star and other brands in the past, and provide information and recommendations to consumers. Utilities and third party administrators need to know what to include in their programs.

The market actor network diagram for this initiative is shown in Figure 12 below:

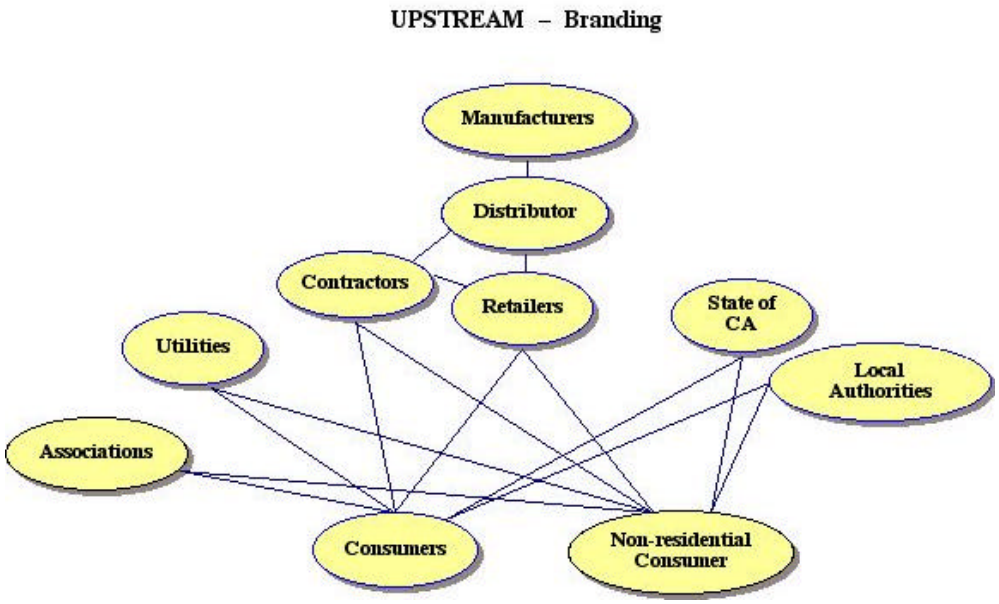


Figure 12. Market Actor Network Diagram for Branding Initiative

Market Conditions that will Affect the Success of the Initiative

There are a number of market conditions that will affect the success of this initiative. These include:

1. The approach that California takes in addressing the branding issue and the confusion the approach initiates in the market. It will be important not to send mixed signals in the market, or all energy efficiency branding will be harmed. Consumer confidence in the brand must be kept at a high level. Brand confusion can be generated if not handled well, as there is already an energy brand in the market.

2. The available dollars that can be provided to establishing a new brand, a co-brand, or in adjusting the tiered approach to program-qualified products. Establishing a brand is expensive and typically measured in tens or hundreds of millions of dollars. It is not unusual to spend millions of dollars in a single brand recognition event.

3. The ability of California to build brand awareness and overcome lack of knowledge in the purchase decisions by customers, but also the lack of knowledge of all types of market participants that have a direct interest in the brand.

4. Accessibility of the energy branded products. If the brands are not easily accessible, they not be adopted. Customers will not wait for brand-associated equipment to become available. It must be in the market before the demand is created.

5. Manufacturer, distributor, dealer and retailer ability to offer branded equipment or to test and certify equipment beyond the current approach. Industry support may be critical, depending on the branding approach taken. Industry must be able to place the products in the market to meet the brand requirements and the products must be promoted by the industry, or the branding initiatives must create enough pull to move the suppliers.

6. The ability of the branding-related initiatives to move decision makers to seek out or specify approved brands.

7. High energy or supply problem prices will drive more customers to branded equipment.

Key Barriers Associated with the Success of the Initiative and Strategies for Overcoming these Barriers

There are a number of barriers to having a branding initiative that the program design will need to address. These include:

1. The lack of strong support in California for a new brand: Few people think that having a new energy efficiency brand to compete with the established Energy Star brand is worth the effort.

2. Industry may balk: Industry may not agree with the notion of placing new branding mechanisms in their path and resist this approach. Without industry cooperation branding initiatives will fail.

3. Market awareness for the Energy Star brand is high and rising each year over the last several years. New initiatives would need to compete for customer recognition.

4. Cost and confusion of establishing a new brand can be high. Brand awareness building is expensive and will result in confusion between competing brands.

5. Market channels and coordinated program support will need to be established for any new brand.

6. New education initiatives would be required to educate a wide range of organizations and professionals that would be effected by a new brand approach.

Strategies for Overcoming These Barriers

There are few strategies for mitigating the barriers identified above that could be easily, quickly or inexpensively implemented. That is the nature of creating a new brand. However, there are several strategies for accomplishing the branding needs without establishing a new brand. These include:

1. Continue to use the Energy Star brand and continue selecting specific models to include in California's energy programs. Use the tiered approach and continue to try to educate consumers: just because something is Energy Star does not mean it is energy efficient compared with the range of choices in the market. Unfortunately this will also increase confusion in the market, as many customers will think that if it is Energy Star, it is the most efficient choice, but then it will not qualify for program incentives.

2. Limit incentives to only specific Energy Star models or establish a new co-brand, but to limit confusion, do not overly promote the brand. Establish an Energy $mart or Energy Commission-Certified (or other name) level of efficiency identification process that moves beyond the Energy Star brand but only qualifies the higher level Energy Star products for program inclusion.

3. Expand the new co-brand into new product lines and service systems so that the newly covered products reflect the co-brand, but not the Energy Star brand. Then, as Energy Star catches up, include the Energy Star brand with the co-brand.

4. Move into new branding aggressively. Promote the Energy Commission-certified kitchen, or the Energy Commission Certified Commissioning approach. Move into equipment as early as possible, do not wait for the Energy Star brand, but lead the way for Energy Star to follow.

5. Work with states like New York, Wisconsin, Vermont and others to build consensus about what products and services should be Energy Star rated. Act as a branding expediter for Energy Star and put pressure on the brand to move into new products and service areas or be left behind as the brand that follows others. Work with federal legislators to have Energy Star move more quickly into brand development. Consider building multi-state brands that are controlled beyond the Energy Star label.

6. Work with Energy Star to develop co-brand names, such as Energy Star-PLUS or BEYOND Energy Star to differentiate products but not fully abandon the Energy Star market recognition.

7. Set Energy Star certification as the minimum level of practice for energy efficient, environmentally effective purchasing, but establish co-branding that is considered for resource acquisition and educational efforts to supplement the Energy Star brand.

These efforts will substantially reduce the barriers associated with developing a whole new brand, and if effectively implemented will allow the initiative to succeed and grow in its impacts.

Market Conditions that Support the Initiative

Within the front lines of energy efficiency there is recognition that the Energy Star brand may not be the best approach for programs that must focus on energy acquisition. There is both dissatisfaction and satisfaction with the Energy Star brand within the professional energy efficiency community. This community is ready to move with a modified approach and other states and organizations have already started in this direction. The pump is already primed to look for alternatives that help gain more efficiency resources.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Interviewees suggested that legislative changes are not needed to move into a new brand, co-branding, or multi-tiered approach to the branding issues. Some interviewees suggested that legislation is not appropriate. Likewise, there is concern that legislative bodies work at paces too slow for the way that markets operate and that legislation may end up blocking opportunities as well as opening opportunities. However, California needs to make a decision on the branding approach and this approach may be best left to policy decisions after a consensus building effort in California and other states has been successful. At this time the decision needs to be made to officially explore the branding options and to more aggressively investigate issues and opportunities not only in California, but with other states as well.

Potential for the Initiative to Achieve Market Penetration or Participation

The potential for market penetration of an energy efficiency brand is significant, as the use of the brand can be specified. That is, all programs that include brand covered technologies and assessment approaches can be instructed to use the brand via a policy decision. If resources are expended to provide recognition to the brand, customers will begin to recognize and use the brand if it is available in stores and through preferred contractors, dealers and distributors. However, customers must be given a reason to use the brand. That is, they must be informed of the benefit of using the brand and they must see the benefits as something that they can support.

However, policy makers need to understand that establishing a brand is a long-term effort in which success is measured in small, incremental changes in recognition and use per year, and these changes are linked to the effectiveness of the brand recognition approaches employed. The funding stream allocated to those efforts can significantly influence the effectiveness of the brand recognition approaches. Thus a

long-term policy decision to build a brand is needed and there needs to be continued support for brand building throughout the duration of the period in which the brand is to be used.

Information, Case Studies and Demonstrations

Sectors: Residential and Commercial

Trigger event: All

Intervention type: Voluntary

This initiative provides technology transfer materials needed to make the market connections to effectively overcome information-related market barriers that would otherwise inhibit the market penetration and use of energy efficient products and services. This initiative supports all the other initiatives in the portfolio. Elements of the initiative include; identifying key market participants; determining related market barriers; designing and developing information products to overcome those barriers; and developing and executing an information dissemination plan to get the information products to the relevant stakeholder. Information products need to be developed and delivered for each initiative recommended in this report and as such will be an integral part of each commercial sector and residential sector intervention.

Information products will include fact sheets and brochures, product directories, and guidelines for design, installation, operation and maintenance. Training materials will be developed that will include manuals, presentations and videos. Walk-through tours of operating installations and connections with industry/association meetings will also contribute to the effort. All of these elements are designed to overcome specific market barriers described later in this initiative.

Other issues addressed in the following sections include the importance and potential of the initiative to affect California's energy supplies, the interest groups that influence and are affected by this initiative, market conditions and key barriers that will affect the success of the initiative, and strategies for overcoming the barriers and maximizing market penetration and participation.

Initiative Elements

The following paragraphs describe the information products, and the case studies and demonstrations needed to overcome barriers to the market penetration of energy efficient products and services.

Information Products

Information products need to be developed and disseminated to help increase the market penetration of energy efficient products. Each of the information products should be designed to overcome market barriers that otherwise impede the adoption

of the desired product by market participants. Market participants can be classified by their function and therefore have similar information needs. Each class of market participants has particular needs that must be satisfied if a new technology is to be specified, financed, installed, operated and used. Most technology product attributes are universally required across all of the functions/chains but some are particularly critical to a subset of the market participants. Information products need to focus their contents on the attributes most important to the market participants or chain of market participants they are designed to address.

Funders, for example will be interested in cost effectiveness, particularly first cost, as well as cost/energy savings. Utilities offering rebates or other incentives to new technologies will also want to know how the technologies save energy compared to conventional systems.

Business Owners are concerned with project planning, obtaining funding, selecting the architect and engineering firm(s), approving the project scope, and tracking expenditures and project progress. Managers are concerned with project specifications that can cost effectively provide an outstanding work environment.

Specifiers will also be interested in cost effectiveness, and how well the system performs compared to specifications. Reduced energy use, improved occupant performance and reliable operation will also be of great interest to this market function/chain. The more technically oriented participants in the “specifier” group will need information on how well the technologies performed in terms of delivering their expected advantages. Similarly and perhaps more importantly are how well the perceived disadvantages have been overcome. The information products that are focused on influencing this group, therefore will pay particular attention to documenting proven performance advantages and how perceived disadvantages have been and can be overcome.

Suppliers need to see demand for their product and/or anticipate product demand. Information products that provide well-accepted performance evaluation, third party testimonials, delivered through the most effective channels to specifiers and others in the supplier chain, will encourage dealers and distributors to stock the product, and manufacturers to produce it. If utilities can be influenced to provide financial incentives, this would be a major step toward increasing product availability and reducing acquisition cost.

Installers would be most receptive to receiving application guidelines showing the simplest and most effective techniques for installing the new technologies and for assuring that they are operating correctly.

Maintenance personnel/operators need checklists of time-phased maintenance procedures as well as operating manuals that could be used to keep the systems working effectively, assuring their continued high performance.

Users of the technology such as building occupants, home owners and customers will be concerned with ease of operation, safety, indoor air quality, temperature control, and noise. A brochure for users/occupants could help them understand the

virtues of the energy efficient systems and will help the occupants to operate them correctly, assuring that the system advantages are consistently received.

Codes and standards setting bodies need information on the performance of new technologies to assure that they adhere to existing requirements. If the new technologies do not comply with existing requirements but nevertheless satisfy the objectives of the codes or standards, then this information should be clearly provided. This will enable the language of the regulation to be changed to permit effective usage of the new technologies.

Information products should be developed by the personnel involved with each particular initiative addressing AB549 recommendations. This initiative should provide oversight and guidance in design and production of the most appropriate information products and in disseminating them in the most effective manner.

While California is a large market and can be a lucrative market for the products and services to be stimulated by this initiative it would be desirable to look to other influential market participants, including energy efficiency advocacy groups (such as NRDC, CIEE, ACEEE or others) and national R&D organizations (such as DOE, EPA, EPRI, GTI or ASERTTI or others) to defray the costs of development of information products and to increase market clout through joint promotional efforts.

Some efforts of this type are currently underway in the Energy Commission PIER program as market connection activities designed to increase the market penetration of the products being developed and demonstrated. The methodologies and examples provided by PIER efforts provide a strong foundation for the proposed initiative.

Case Studies and Demonstrations

Market participants tend to favor systems and technologies that have performed well for them in the past. As such there often exists a very substantial resistance to change. Performance information needs to be provided to overcome this resistance to change, and to minimize risk, by assuring market participants that energy efficient products will perform as desired. In this regard, the best approach is to provide the market participant with examples that reinforce the desired outcome. Demonstrations that will provide the desired information are recommended. The information to be derived from these demonstrations should be documented in case studies and guidelines that permit the new adopter to replicate the success of the demonstration. Market participants have different roles in the specifying, design, installation, operation, maintenance, supply, and funding of the energy efficient products and services and as such require different types of information to be derived from these demonstrations. For example, an operator would desire information on reliable performance, and how to operate and control the equipment. A specifier would also desire information on cost effectiveness, and sizing. (The market actor section of this intervention describes these roles.) Specific market interventions are suggested to address the market barriers influencing the decisions of each decision maker/market participant.

Demonstrations need to be designed to overcome the market participants natural risk aversion and resistance to change. To be most effective the conditions for the demonstration should be as similar as practical to the conditions of the decision/maker trying to decide whether to specify or endorse specification of the new technology. The test protocol needs to be thoroughly designed to obtain all the information needed for the new technology compared to a conventional "control" unit. Careful monitoring needs to be made using state of the art data recording and retrieval to assure measurement accuracy and real time analysis of the data needs will permit detection of test anomalies in a manner that affords quick correction. Access to the test site should be permitted to assure parties that conditions are similar to what they are likely to experience. Concise, well written reports should be provided. Demonstration information should be used to prepare fact sheets and brochures, as outlined in the following section.

Information Product Attributes

The types of products to be produced should include the following:

- Fact sheets, brochures, and flyers featuring case study information from demonstrations
- Journal Articles/ Technical Papers
- Presentations
- Application Guidelines
- Training materials and training sessions
- Walk-through tours
- "Word of Mouth" contacts using the materials above

Fact Sheets

The fact sheet format will likely consist of the following material:

- A Description of the Situation (Describe the problem and the current technology being used.)
- The Technology (Describe the technology, what it looks like, how it works, and how this differs from current practice. Provide a schematic or photo of the technology.)
- Advantages and Opportunities (Clearly outline the advantages of the new technology and situations where it can best be applied.)
- Applications (Provide examples of effective applications with initial cost, and operating cost clearly stated.)
- Case Studies (Describe the sites in the study, provide a photograph of the building(s), installations(s), describe the problems overcome, benefits,

challenges/lessons learned that can help someone avoid a similar problem, and provide testimonials from the specifiers/users.)

- Sources of Information (Provide authoritative references, opportunities to obtain additional information and technical assistance in implementing the new technology.)
- Other Issues (If applicable, present information on ancillary issues, applicable codes and standards, health and human performance improvement; items not covered in the main body of the fact sheet.)

Fact Sheets will be produced to suit different audiences. While a substantial amount of the Fact Sheet material will be similar for all audiences, each audience will be provided with more details addressing their areas of concern. For example, demonstrated cost effectiveness is likely to be more important to funders, specifiers and energy service companies than it would be to teachers. Occupants on the other hand would mostly be interested in ease of operation, safety, indoor environment (temperature control, fresh air, and good acoustics) and attractive appearance; factors that influence the work or home environment. Facilities and maintenance personnel will want to see evidence of reliability as well as ease of operation and information on installation and maintenance requirements.

Journal Articles/ Technical Papers

- Contacting appropriate engineering journals and trade publications to place at least articles (drafted by the initiative leads) that explain the benefits of the energy efficient products and service.

Presentations

- Presentation materials for explaining the benefits of energy efficient systems and services to promote understanding of these systems and services among market participants with the goal of including these systems in specifications for retrofit situations.

Application Guidelines

- Application guidelines dealing with the maintenance and operation of equipment for facilities and maintenance personnel
- Guidelines citing the benefits and applications of energy efficient systems and services for decision-makers controlling design and construction of major remodels and retrofits.
- Promoting understanding among mainstream design professionals of energy efficient system applications and practices in residential and commercial buildings.
- Guideline Format

- Description (Description of the technology, including a photo or schematic, indication of applicable space, climate, and when to consider the technology in the planning cycle. Variations and options.)
    - Applicability (Configuration, building type)
    - Applicable Codes
    - Integrated Design Implications
    - Cost Effectiveness
    - Advantages/Disadvantages
    - Design Tools
    - Design Details
    - Operation and Maintenance Issues
    - Commissioning
    - Attributes of Available Products
    - References/Additional Information

The information provided in the guidelines and the format used will be tailored to suit the audience. For example, guidelines for maintenance and operation of energy efficient systems may be different than those for conventional systems. To provide guidelines useful for facilities and maintenance personnel would necessitate substantial expansion of the operation and maintenance section of the guidelines to include instructions to deal with settings and controls issues, calibration issues, software training issues, automatic and manual overrides; maintenance items and schedules and other related items. Guidelines useful to specifiers would include material on the specification of available energy efficient products.

Training materials and training sessions

- Contacting appropriate staff at the five utility sponsored energy centers would be useful in organizing and promote pilot training sessions for the energy efficient systems and practices addressed in the program initiatives
- Working with the initiative leads to assist them in finalizing special all-day and half-day training curricula for the initiatives based on pilot training
- Include information from the fact sheets, application guidelines, technical papers, journal articles and presentation materials in the training materials
- Assist in developing guidelines for energy efficient systems in ongoing training programs such as the CHPS training program
- Training sessions and corresponding presentation materials should be developed for equipment specifiers, installers, operators, maintainers and users.

Walk-through tours

- Arranging and conducting walk-through tours at demonstration sites, including provisions for these tours and for on-site meetings in the site agreements

Word of Mouth" contacts

- Creating a "word of mouth" movement by involving opinion leaders in the process of convincing them of the benefits of the systems, services and practices contained in the Program initiatives
- Helping initiative technical staff to work closely with a opinion leaders and influential market participants to assure that the initiative is designed to meet their needs and that the results are accepted by their peers
- Establishing contacts and facilitating relationships working with legislators and/or the state allocations board to provide incentives for modernization projects that employ energy efficient systems
- Working with manufacturers to promote awareness of the market need for developing new lines of products, or adapting existing products, to the energy efficient application with the greatest energy and demand saving potential.

Program staff should attend key meetings to "get the word out" to influential market participants. Program staff should regularly interact with federal and state government personnel in the normal course of their business, HVAC professionals at ASHRAE, business personnel at association meetings, utility personnel and specifiers at training sessions at utility energy centers across the state, and a range of experts and market participant at Industry meetings.

What is needed is a technology transfer/market connection effort that extends well beyond the completion of any RD&D (research, development and demonstration) advocated in other initiatives in this program---for perhaps two years or more to assure that the energy efficient products get a chance to "grow up" before they are overwhelmed by cheaper, otherwise easier to sell less efficient products. Within narrow limits manufacturers will sell whatever is easiest to sell. It's up to the energy efficiency advocates to provide the information and the infrastructure support to make efficiency an easy sell. The technology transfer products should be designed to overcome market barriers, including a lack of familiarity with the equipment, uncertainties in how the equipment will perform, lack of knowledge of product or service availability, lack of understanding of installation, operating and maintenance issues, transaction costs, and resistance to change with well designed and presented product directories, case studies, and guidelines for specifying, buying, installing, operating, monitoring, maintaining and servicing the energy efficient products developed in this upstream initiative.

Importance of Initiative to California's Energy Supplies

California is the most populated state in the United States with a large market for energy-using products. California has been a leader in increasing the energy efficiency of buildings and as such, market participants look to California to play a leadership role in bringing energy efficient products to the market and in encouraging their market penetration. A well-coordinated program of interventions is recommended that includes providing information that overcomes stakeholder barriers that inhibit their adoption of energy efficient products and services development. It is important for California government to take the lead in encouraging the adoption and use of energy efficient products that have a strong impact on California and the nation.

Coordination With Other Interventions

This initiative supports all the other initiatives in this program and as such needs to be coordinated with each of them by providing oversight and guidance in identifying information barriers impeding their success and designing and disseminating corresponding products to overcome those barriers.

Organizations, Associations, and Stakeholders Affected by the Manufacturing Partnership Initiative

The following tabulation identifies the key interest groups that are affected by this initiative and influence this initiative. Since this initiative supports all the initiatives in the program, all interest groups in their respective sectors need to be considered.

ASSOCIATIONS – Industry groups and trade associations will need to support the technology transfer marketing efforts to encourage market penetration, and to encourage training of their constituents to adequately deploy new technologies.

BUILDING OWNER – The largest private and institutional owners "…are the most important players in general." They serve as role models to other property owners and building managers. As one observer put it "If you could get the big owners to demonstrate– the smaller guys may see it and think 'I could do that too.'" Another suggested that "The large owners also hold the largest market share, and they may inspire smaller owners to improve their own buildings."

CONSUMERS – Can provide useful models (sources of ideas) for consumers and can be a first stop in research for those who are "… in the habit of researching an improvement to their home." Can also demonstrate a complete working solution (i.e., "I don't have to look into whatever the idea was, because someone else already did the work, what a relief."). At the same time, other consumers may not be persuaded by demonstrations, choosing to rely on trusted vendors, brands, contractors' advice, etc. (e.g., "I don't care, I just want a Whirlpool.").

CONTRACTORS AND SPECIFIERS –Contractors often select the product to be installed in a retrofit, major remodel situation and as such will be users of the information provided to assist in product selection and use.

DISTRIBUTORS –The distributors of energy efficient products can use technology transfer and promotional materials and activities to make it easier to sell these products.

LENDERS – This includes other groups in lending/real estate networks, including real estate agencies, appraisers, and secondary mortgage brokers. They are likely to be eager recipients of any documentation of building performance that allows them to assess a prospective building owner's operating costs and therefore their ability to repay a loan.

MANUFACTURERS –Manufacturers will be the focal point for distributing the technology transfer materials developed to overcome the adoption barriers of market participants.

NONRESIDENTIAL CUSTOMERS– Nonresidential customers will benefit from increased availability of energy efficient products and the information needed to make informed market decision and to use the product effectively.

RESIDENTIAL CUSTOMERS – Residential customers will benefit from increased availability of energy efficient products and the information needed to make informed market decisions and to use the product effectively.

STATE OF CALIFORNIA, Energy Commission (PIER) – The Energy Commission (in partnership perhaps with DOE, ASERTTI and other R&D funders) organizations could provide funding for the technology transfer and market connection activities advocated in this initiative.

STATE OF CALIFORNIA – The state is a very large owner and tenant of commercial real estate, providing sites of previous and potential future demonstrations. The state has distribution channels that could be used to disseminate relevant information to their constituents.

U. S. GOVERNMENT – The federal government is another very large owner and tenant of commercial real estate, providing sites of previous and potential future demonstrations. They would be a consumer of demonstration information. The U.S. government has distribution channels that could be used to disseminate relevant information to their constituents.

UTILITIES – Utilities should be one of the best sources of product and performance information that can help promote energy efficient products and services. Utility energy centers can be a focal point for training and for distribution of information products. They have been a previous sponsor of demonstrations.

This initiative, if successfully implemented, will have an effect across the market. Product manufacturers will be stimulated to produce and promote lower-cost, energy-efficient products. Associations of manufacturers, such as ARI (Air-conditioning and Refrigeration Institute, CRMA (Commercial Refrigeration Manufacturer's Association), AHAM (Association of Home Appliance Manufacturers) and GAMA (Gas Appliance Manufacturer's Association) and others will be encouraged to develop test procedures, training materials, courses and ratings for

the energy efficient products. The initiative will make it easier for distributors and dealers to sell high efficiency products by reducing their cost and providing ancillary materials and support to facilitate sales. Consumers and specifiers will be provided with cost effective, higher efficiency products and the information needed to select, install and operate this equipment. Organizations such as ASHRAE (American Society of Heating Refrigerating and Air Conditioning Engineers), and ACCA (Air Conditioning Contractors of America) that represent these market participants will play key roles in providing this information and monitoring its utilization. Utilities such as PG&E, SCE, SMUD, SCG and SDG&E that maintain energy centers will be provided with information materials for distribution to their customers and for running training sessions to educate key market participants. Utilities will be able to satisfy their demand-side management objectives more readily of cost effective, energy efficient products become more readily available as a consequence of this initiative. As more energy efficient products are placed in the market, suppliers and service contractors will obtain more experience with the energy efficient choices, creating a stronger service sector for the energy efficient choices. These changes should occur in the entire market, and thereby affect all interest groups and technology consumers. The result will be increased efficiency across the product stream. If successfully launched, many product lines should be impacted by this initiative. If successful, the impact of this initiative will grow in the market as other R&D organizations partner with the Energy Commission to further leverage this initiative.

The market actor network diagram for this initiative is shown in Figure 13 below:

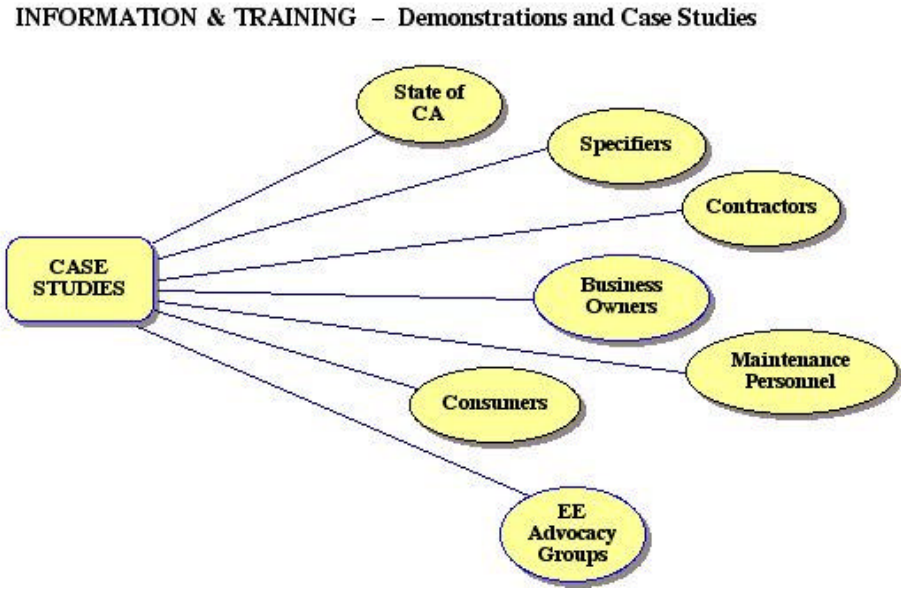


Figure 13. Market Actor Network Diagram for Demonstrations and Case Studies

Issues and Market Conditions that Will Affect the Success of the Initiative

There are a number of issues and market conditions that will affect the success of this initiative. These include:

Finding funding to support this initiative will be the first hurdle to overcome.

Funding could come from utilities, from the Energy Commission, including the PIER program and from partnerships with manufacturers, other R&D and energy efficiency advocacy organizations and other market participants.

Coordination with other initiatives will be a key to optimizing the cost effectiveness of all initiatives in this Program by providing well-designed and well-executed market connections, and information dissemination efforts. A coordinated effort will be required between all interest groups to make these efforts successful.

The manufacturer's distribution chain needs to buy into the marketing and sales efforts for the energy efficient products that are developed and promoted. The distributors and dealers need to avail themselves of the ancillary information products provided to them as part of the marketing campaign and use them to overcome the market barriers of those specifiers and customers making product selection choices.

Prevent price gouging. As the product becomes successful and sales grow, the distribution chain needs to moderate their natural desire to increase product prices to increase their profits and as such dampen demand and reduce sales momentum.

Energy efficient product shortages may occur. If the initiative is rapidly successful there may be a shortage of the energy efficient technologies and products in the market and an over-abundance of non-efficient choices, causing a price drop in the non-efficient choice, thereby potentially boosting their market demand, causing more of the lower cost items to be placed in the market.

Familiarity can breed acceptance. As the energy efficient choices become more established in the market, parts and service for the inefficient choice may become a lower priority for stocking practices.

Key Barriers Associated with the Success of the Initiative

The barriers associated with this initiative are principally the market barriers inhibiting the selection, installation and use of energy efficient products and services.

An educational system or operational structure is needed that can place energy efficient information into the hands of the decision makers. Interviewees point out that "people don't always know what is efficient and what to buy, they need to be educated about the fact that you can buy in a way that is energy efficient and environmentally friendly." Because the level of energy efficiency across different

makes and models changes all the time as a normal course of the market operations, there needs to be a way that specifiers are kept up-to-date on what is efficient..

Performance uncertainties exist that inhibit selection of energy efficient products and services. Market participants need to experience the performance of energy efficient technology as it is affected by their own unique operating conditions, practices or preferences.

Asymmetric information and opportunism exists wherein sellers of equipment and services know more than buyers. Obtaining equivalent information may be costly or impossible for the buyer.

Hidden costs occurring because of unexpected operation, monitoring, servicing or maintenance costs can be minimized by providing operating, monitoring, servicing and maintenance guidelines for facilities and maintenance personnel.

Rules of thumb and standard selection practices often limit consideration of new technology options. There is a bureaucratic tendency to be risk averse. Misplaced or split incentives exist with institutional relationships where the person charged with deciding on adopting a new technology is not the person who benefits from the technology.

New products may not be readily available because of stocking practices of the dealer networks.

It may not be clear if a technology can be deployed in retrofit situations and the means to do so may not be clear.

Existing codes and standards may not properly account for attributes of new technologies making it difficult to favorably deploy the technologies in their most suitable applications.

Strategies for Overcoming these Barriers

Existing infrastructure should be used as much as possible to place energy efficient information into the hands of the decision makers. This could include utility networks, trade association and industry publications and distribution channels.

Specifiers and installers need a directory that provides the characteristics and performance of available energy efficient products and practices and where to obtain them.

To overcome resistance or change and related performance uncertainties, market participants need case studies based on well-documented performance demonstrations and testimonials from their colleagues with similar requirements.

Information on ownership costs, energy, and performance from a reputable third party, is needed to assist the buyer/specifier in making a selection/purchase decision. Associated training and technical assistance would be helpful.

The cost of acquiring energy efficient products, i.e. transaction costs, can be minimized by providing guidelines, training and technical assistance for specifying, buying and installing a product.

Hidden costs occurring because of unexpected operation, monitoring, servicing or maintenance costs can be minimized by providing operating, monitoring, servicing and maintenance guidelines for facilities and maintenance personnel.

Case studies documenting cost effectiveness and other performance advantages are needed to overcome rules of thumb that might otherwise inhibit consideration. Case studies focused on economic, and other benefits can help overcome the bureaucratic tendency to be risk averse. Both case studies require strong messages that clearly show benefits.

Case study information to help the manager/specifier understand the energy, health and productivity benefits of the new technologies should help overcome the problem of split incentives and encourage consideration of organizationally beneficial technologies.

To assure that new products are readily available, aggressive publicity for the product should be employed to increase awareness of the need for increasing inventories to keep up with demand.

If retrofits are possible, make it clear that this is so and also provide clear instructions on how to modify the building for these retrofits and how to install the product.

To assure that existing codes and standards properly account for attributes of new technologies, the performance of the new technology should be documented, providing evidence that a waiver or alteration is required in the existing codes and standards. The information should then be prepared, packaged and presented to influential individuals and organizations to affect the desired changes.

The following programmatic actions would help mobilize this effort.

Identify Information Dissemination Opportunities - Look at all other initiatives in this Program to identify market barriers and corresponding information product opportunities for overcoming these barriers.

Design Information Products – Prepare a plan for developing information products to overcome market barriers that includes fact sheets, brochures, guidelines, training materials and training sessions, presentations, papers, and walk-through tours. This will include design and execution of demonstrations to provide documented, credible case study information.

Develop Information Dissemination Plan - Prepare a plan for distributing information products to overcome market barriers that includes fact sheets, brochures, guidelines, training materials and training sessions, presentations, papers, and walk-through tours. Utilize utilities and their energy centers, government organizations and their clearinghouses. manufacturers and their distribution chains, industry trade associations and their channels to reach building owners, specifiers, facility

managers, users, and energy efficiency and environmental advocacy groups, to effectively disseminate information to their constituents.

Develop and Disseminate Information Products – Execute the information products design plan and the information dissemination plan to develop and deliver information products to support all the initiatives in this Program.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Infrastructure exists to permit this initiative to move forward in California. What is needed is a concerted effort to focus more attention on issues related to AB549 and to provide increased funding to permit effective execution of this initiative and the other initiatives recommended for the program.

Potential for the Initiative to Achieve Market Penetration or Participation

The potential for this initiative to achieve significant benefits over several years is significant. The information products in this initiative will leverage and multiply the market penetration of the other initiatives in this program. A significant fraction of end-use product types could be influenced by this initiative. Successful information dissemination/market connection efforts, as outlined in this initiative, could increase market penetration by a factor of two or more over a program not utilizing this Information, Case Study and Demonstration initiative.

Energy Efficient Technical Training and Certification Initiative

Sector; Residential and Commercial

Trigger event: None

Intervention type: Voluntary (Certification could be Mandatory)

This initiative focuses on a training and certification initiative for expanding building-level energy efficiency assessment skills in the market. In addition, the initiative also includes a certification component to guarantee that technicians and building assessors providing energy services are sufficiently trained to provide these complex, interactive assessments and services. It is anticipated that certifying experts will help to influence the quality of the professionals providing these services to assure that a high quality assessment product is provided. This will help establish market confidence in the related high efficiency products and services leading to expanded market demand for high efficiency. Several experts, who were interviewed in this study, or who served on one of the expert panels, expressed a need for a training program that can be supported by energy efficiency funds to improve the skills of practitioners and build market demand. However, it was noted that the training and certification initiative must be implemented in close coordination with market development initiatives aimed at building market value and stimulating customer demand by demonstrating the ability of skilled professionals to provide valued services that result in energy savings and improved internal and external environmental conditions.

The training and certification initiative discussed in this section focuses on training two types of individuals. On type is the energy assessor who can diagnose a building's energy related performance problems and make recommendations to solve the problem ultimately by making the building more energy efficient. There also are needs for a training and certification programs for builders of energy efficient structures and installers of energy efficient equipment. These market actors are capable of building structures and deploying energy efficient equipment to achieve maximum energy efficiency at the building performance level and maintain satisfied occupants. The training efforts may need to be segregated into efforts focused on construction practices, operational practices, installation practices, and approaches to improve energy performance in existing buildings. The different course content needed for these functions should be considered further as the training development process is developed.

The trigger events associated with this initiative are the educational processes that are used by people entering, or wanting to enter, the energy technologies and technology services field. Continued educational needs for those already in the field present another opportunity. While these are not the only possible trigger events,

they are the events in which a training and certification initiative will capture the most interest.

Energy Efficient Technical Training and Certification

One of the key market barriers to expanding energy assessments as an approach to capturing more savings is the number of people entering the energy assessment field in specific, and the energy equipment performance field in general. Several interviewees and experts indicated that a lack of highly skilled, trained and certified individuals (especially at the whole building level) could stand in the way of initiatives designed to expand the number of assessments that can be conducted in California to achieve energy savings. There was general support across the interviewees and the experts taking part in the panel sessions that California needed to launch a program that moves more individuals into the assessment field to respond to increased demand for these services as influenced by California's energy efficiency programs. However, these experts also indicate that training must integrate technology issues into a whole building assessment approach. The training must be well developed so that it provides people with needed skills, provides a method for certifying who has these skills, and is linked to initiatives that build service demand.

Experts also indicated that the market for these individuals is tight and barriers exist that will need to be overcome regarding the educational system's financial ability to provide training and the time constraints on people who will need to obtain the training and certification. Likewise, experts warn that the training must be linked with demand-building initiatives so that trained and certified individuals can readily find positions in the markets in which their skills can be applied. Other initiatives presented in this report will build this demand for skilled professionals. Experts suggested that training institutions will need financial help in establishing and providing the programs to produce trained and certified experts. This jump start is needed, at least in the short-term, until the training programs become well established and provide clear value to the students.

Interviewees suggested that technical training and certification should focus on building commissioning to assure that trained understand how to discern whether the systems in the buildings work together to achieve savings instead of working against each other. Interviewees and expert panel members agree that the people typically responsible for building operations and maintenance do not have the skills to understand buildings from a systems-approach. These people work on the systems one technology at a time, and building decision makers often use outside contractors for these services. The outside contractors are often operating a "low-cost" mode and have to get in and get out quickly to make a profit. As a result they work on the building's issues one technology at a time. It was also noted that building owners and operators often do not know that they have systems that are not well maintained, not working together or are working against each other. It was suggested that there is a need to educate building decision makers that buildings can have systems that work against each other and that this has an impact on comfort and costs if not properly addressed. The initiative would need to focus on

educating building owners, managers and operators about energy and non-energy effects of poor performing buildings to enhance market pull for energy efficient buildings and practices.

Training at the residential level is suggested to focus on increasing the supply of building auditors so they have the skills to assess technology level problems, but also to assess building-level problems that affect energy efficiency. This effort would also need to move ahead on several fronts, increasing market knowledge, demand and skills simultaneously.

Interviewees, as well as expert panel members stressed the importance of energy efficiency, occupant comfort and establishing a safe internal environment. These people also think that when people purchase a home or building they should be advised of the energy efficiency and environmental conditions of the structures they are buying. As a result, there is support for establishing a requirement that all buildings receive a detailed whole-building energy assessment during the property inspection process prior to a change in ownership. There is also general agreement that this will require a significant increase in the number of skilled professionals to fill this need. If California is to move ahead with making energy inspections part of the real-estate purchase process, more professionals will be needed to provide these services. The auditing and assessment industry will both need help in meeting the demand for skilled professionals that is placed on the system.

In addition to mandatory energy efficiency inspections required as part of the real-estate transactions, several interviewees and panel members indicated that if decision makers know that their buildings can be significantly more energy efficient, more comfortable and safer, there would be increased demand for professionals to do energy efficiency inspections. However, if demand was increased through an educational approach, training support would be required to produce the needed assessors. As part of this AB549 research, several individuals suggested that these assessors will need to be certified so that there is confidence in the services they provide, but more importantly so that the assessment is done professionally and that the quality standard for the assessment process is kept high enough to maintain service demand, strong energy savings and acquired benefits from implementing assessment recommendations.

Technical Training Grants

One way to initiate an education and certification effort, which was supported by several interviewees and expert panel members, is by establishing training curricula within the technical and community colleges. This training would thus be incorporated into the college's building trades and technologies curricula creating a professional development course within the currently established trade's development courses. This would, of course, require planning, materials development, and equipment acquisition, linked with strong training oversight and monitoring. Unfortunately, in the last 30 years schools have moved away from these types of training efforts because of the high cost of the training and correspondingly lower training budgets. It is much cheaper to have a room filled with desks and teach

math than it is to train people in a laboratory on a range of equipment and equipment interactions and operational characteristics. As a result, technical and community colleges have been reluctant to provide energy assessment training unless that training is underwritten through a reliable funding source. Policy makers should consider providing training initiative resources to the technical and community colleges through the current funding sources available for California's energy efficiency efforts.

Panel experts suggested that the real estate profession is not fully aware of the benefits of energy assessments or the value of an energy efficient home and are interested only in moving the home as quickly as possible. These concepts may not be mutually exclusive.

Interviewees suggested that a state-wide education and training initiative could be developed for about $20 million dollars a year and could be implemented and begin producing skilled professionals with advanced skills in about a year. Experts suggested the following training options:

Focus on a building systems approach: When developing training efforts, they should fit within a systems approach to energy efficient construction practices and assessment techniques. Trainees will thus be made aware of how construction and specifying practices affect the efficiency of the buildings, not just the efficiency of parts of the building or of the technologies. This approach can be an integrated approach where the overall goal is system knowledge, with individual training components focusing on key technologies and practices and both their stand-alone and integrated performance. Interviewees suggested a systematic buildings program that covers all the basic parts, but ties the results together so that a gain in one place is not lost in another place.

Provide both residential and nonresidential course components: Small residential and residential-sized structures behave differently than larger buildings such as commercial and large residential structures. They have different technology needs and different performance characteristics. Training and experience in residential structure assessment and construction does not equate to providing adequate skills for larger structure assessments or construction.

Training should be tied to achieving certification: Interviewees suggested that there needs to be a strong certification program in which contractors that obtain training, or can demonstrate knowledge and skills, can be certified as an energy efficiency professional capable of assessing or installing/building the most highly efficient equipment and structures. There may need to be a Master Energy Certificates for Assessors, Installers and Builders.

Experts agreed that the educational system, as it is currently configured and funded, may not be able to adjust to providing these services without some support in the form of grants or other financial support. The financial support should be linked to a performance assessment effort that monitors how the funds are spent, to assure that the training is of high quality and meets the needs of the developing field.

Certification Process

Interviewees and panel members suggested that there needs to be a certification process in place to make sure that people in the field who are doing the assessments (especially if required as part of a real estate transaction) installation and construction efforts are properly skilled. Panel members noted that there are many openings in the energy equipment maintenance and operations field and that the construction field can be somewhat transitory, resulting in many unskilled people being involved in both of these fields. There is a need to make sure that people doing energy assessments are trained and skilled in these area, and to make sure that building professionals doing Energy Star or branded buildings know what they are doing.

Panel members and interviewees also noted that energy auditors and assessors need to be highly skilled and understand not only equipment performance issues and approaches but also need to understand how equipment systems and buildings interact and how to look for and find improvements. This also applies to construction professionals. Experts noted that there are certification organizations that can take responsibility for the training task if supported to do so. Experts noted that NATE already does certifications and can expand to up-grade the process in California. NATE is now getting ready to launch an advanced certification process for HVAC systems that could be applied to California. And energy efficient construction practices should be incorporated into current construction trades programs.

Other expert panel participants suggested that HVAC systems are going in without proper set-up procedures and suggested that the State establish certification procedures for installers so that installations are done properly. It was noted that many systems are installed or tuned improperly and that effective training and certification was needed to correct these deficiencies.

Expand Audit Training to Whole Building Systems Approach

Several experts noted that auditors need to be trained in whole building assessment techniques. They suggested that it is not enough to inspect the key components of a structure without an assessment of the interrelated performance of the building components. Examples include: duct systems that work against heating or cooling requirements; lighting and other systems that overload space-conditioning equipment; lack of use or effective use of untreated or outside air; lost opportunities to use heat recovery when parts of a building need cooling while other parts need heating; technology selections that work, but are the wrong technology for the building's configuration or use; improperly sized equipment requiring adjustments to compensate, which increase energy use; poor circulation or moisture control that reduces insulation performance or causes health problems, etc.

Experts agree that the auditing training needs to not just focus on individual technologies, but also focus on the interaction of the technologies and the performance of the building.

Importance of Initiative to California's Energy Supplies

One of the best ways to limit the need for new power plant construction and increasing energy demand is to help buildings use energy wisely and efficiently and to help new structures be energy efficient. When buildings waste energy or use energy inefficiently additional demand must be purchased to offset this use. California is the most populated state in the United States and has more homes and buildings that use energy, requiring extensive power generation and consumption. It is estimated that energy consumption in the typical home or office building can be reduced by between 20 and 35 percent if current cost effective, readily available technologies are used. However, identifying where the savings can be achieved, and what changes are needed to the building to achieve these savings, requires skilled energy assessors and well-constructed buildings. Providing a way for the market to acquire these skills is critical to capture savings. While this initiative itself does not produce savings until the skills obtained are put into practice, it is nevertheless an important component of efforts to increase building efficiency.

Coordinating this Initiative with Other Interventions or Activities

There are a few interventions, with which the training and certification initiative should be associated. This Training and Certification initiative will provide the skills and credentials that support many of the other initiatives presented in this report. These interventions include: Audits; Retro commissioning; Whole Building Diagnostic Testing; Inspections and Energy Ratings; and Tune-ups and O&M.

Organizations, Associations, and Stakeholders Affected by the Training and Certification Initiative

The organizations that are participating in this initiative and will be affected by the initiative are outlined as follows:

- Oversight organization: A central authority will be needed to handle the development of this initiative, to focus on course needs and to work with stakeholders to design and launch the initiatives and to oversee and monitor performance. An organization like the Energy Commission or an independent private sector or non-profit organization skilled in these approaches will need to carry the ball and champion the effort. They will need a strong background in energy efficiency, energy auditing, installation practices, assessment skills and understanding of energy efficient design and construction techniques. They should also have skilled people who have extensive experience in the construction and trades industries and understand how educational systems are integrated into these trade industries.
- Technical and community colleges: These are typically the best institutions in which to place trade and trade associated training efforts. There is a generally recognized need within this arena to provide skills development training. This initiative is consistent with this recognized need. If financial support can be provided, the technical and community colleges should be receptive to expanded

skill development efforts for the energy efficiency assessment, contracting and construction industry.

- Certifying organizations: Certification of knowledge and skill levels will need to be incorporated into the training efforts. These can be considered for implementation via the colleges that provide the training, via state agencies that handle licensing or via non-profit organizations that specialize in certification programs, such as NATE (North American Technical Excellence).
- Utility companies: Many customers look to their energy providers to help them with energy issues. The utilities companies would need to be supportive and provide guidance to owners who wanted or needed this type of service. As a result, customers would consult their utility companies for guidance and recommendations about this service and the benefits. Utilities will need to be "on-board" and be able to recommend the service to their customers. As a result, the utilities should be involved in the development of the education and training efforts to have confidence that the service can provide customer value. Utility energy centers might serve as training sites for selected courses.
- Real estate industry: If energy inspections were to become required at the time-of-sale the real estate industry would have to be supportive and actively incorporate the initiative into their processes (see audit and assessment initiative). As a result, it would be appropriate to include the real estate industry in the development of the training and certification initiatives. Assessors would need to be well educated in the real estate transfer process and the timelines required of that process. It would be critical for the energy assessment process not to slow down the transfer process in any way and assessors will need to be knowledgeable about these processes. This would be a critical part of the education and certification initiative.
- Equipment suppliers: The training will need to cover a wide range of equipment that is found in commercial buildings and in homes. As such it may be appropriate to involve equipment suppliers in the training development coordination efforts. They may be able to help guide some of the training curricula development with respects to their equipment and operational characteristics.

Other interest groups connected to this initiative include:

ASSOCIATIONS – Industry associations play a variety of roles in certification of products, programs, processes and personnel. Some associations actually construct certification standards, deliver training, administer tests, and award certifications. Some offer certain services (e.g., testing and certification) and leave the others (e.g., training) to other entities. Trade groups promote certification and refer prospective customers to certified dealers or contractors. Some professions (e.g., home inspectors) may be able to use certification of products and processes as sources of information about system design and quality. For example, having an Energy Star air conditioner, refrigerator or performance-tested house may be a marker of quality and formally noted on inspection reports. To the degree that individual professionals are

not in a position to establish standards and benchmarks, the certification process at the industry association level serves that purpose for them.

Industry associations are seen as particularly important actors in this area. They include trade groups for general contractors, remediless, HVAC and specialty contractors, labor unions, and energy services professionals. One observer noted that their role is particularly important because "…they are reaching individual contractors directly and are already part of the infrastructure." Organizations include North American Technical Excellence (NATE) and the Air Conditioner Contractors of America (ACCA) among others.

BUILDING OWNERS AND MANAGERS – Some observers noted a perceived value to some owners to secure Energy Star status for their homes or buildings. Energy Star and other certifications also provide confidence of product/process quality and performance that reduces search costs and time required when making efficiency choices, which is important given the variable level of sophistication of building owners, property managers, and building operators. Others noted the advertising value of Energy Star building recognition.

CONSUMERS – Homeowners, and to some degree renters, have a stake in making good decisions related to the energy-using characteristics of their appliances and homes. Consumers are familiar with certification in a number of market contexts. For example, they understand UL listing, J.D. Powers ratings, Good Housekeeping seals of approval, USDA organic standards, AAA approval, etc. They understand that some third party has something at stake in issuing an evaluation of the product, process or professional being certified. If the certifier is a trusted agent, then the fact of certification can be taken as evidence that objective standards were applied and met to earn the certification. This stands then as a concise source of information for decision-making in cases of complex choices with limited information. It allows the consumer to "cut through the noise" and make a responsible choice with a minimal amount of effort (and transaction cost).

Residential energy consumers are seen by multiple observers as a potent source of support for energy efficiency products and services. This is because they are perceived to care about their personal impact on the environment, to be concerned about dependence on foreign sources of oil, and to be generally motivated to "do the right thing." They are also perceived to have an affective "concern for maintaining the home," as well as a financial stake, since "…people are not able to move because of tight housing markets; they just need to stay put, and will invest in the house that they have." Certification allows them to make good choices in their home improvement and maintenance investments.

Consumers expect technically competent and well-trained designers, contractors and technicians to be working on or assessing their homes. Systems of product warrantees and service guarantees support those expectations.

CONTRACTORS – Observers note, however, that contractors and their employees chronically lack expertise in energy efficiency. They cite a lack of training, employee turn-over, poor supply of trained workers, need to complete jobs quickly, lack of regulatory oversight, lack of professional standards and peer pressures, and a host

of other causes. These problems are identified in large firms as well as small ones. In addition, the limited success of some trained contractor's efforts to develop whole house diagnosis and retrofit businesses have been traced to lack of basic business skills.

Innovation and change among contractors is driven by code changes, requirements imposed by suppliers (e.g., HVAC equipment manufacturers), and observed changes being made by competitors. As one observer put it: "everyone else is doing it"—i.e., a fear of "being left behind" or need to stay current, works in motivating the market.

It is important to note that contractors cultivate a customer base and many consumers enjoy long-term relationships of trust with particular contractors (regardless of whether the energy advice provided is as good as it could be).

ENERGY EFFICIENCY SERVICE PROVIDERS – These include specialized property managers, consulting engineers, ESCOs, manufacturer's representatives, commissioning agents, retailers, etc. A newly emerging group is the "systems integrators"—specialists that can look at buildings from the system perspective. They may perform the testing, provide recommendations and implement changes, or just parts of that continuum of services.

HIGHER EDUCATION – This includes technical schools and community colleges offering specialized training in HVAC, energy auditing, energy management, building operations, etc. These institutions are primarily responsible for providing training to new people entering the market as technicians and contractors. They have been adversely affected by budget cuts and have moved away from the trades focusing more on four-year college prep course work. There now are relatively few schools offering comprehensive training in any of the areas of interest to this initiative. Also there is an existing adult education infrastructure that offers some level of ongoing and introductory training.

LOCAL AUTHORITIES – In addition to schools, city and county level economic development programs can provide training in basic business development and management needed for successful contracting businesses. Also, cities and counties have credibility related to buildings, licensing, and in some cases energy, which allows them to offer at least incidental advice in response to consumer requests for information about trained contractors for energy improvement.

MANUFACTURERS – Some manufacturers currently require certification of technicians who work for the contractors to which they supply products (e.g., in HVAC contracting firms to which a manufacturer is a major suppliers of product and support).

Manufacturers provide training for retailers, distributors, installers, and technicians in operations and repair of HVAC, appliances, and production equipment. Manufacturers might be participate in this initiative by donating equipment to the training programs and providing corresponding installation and maintenance manuals and materials.

SERVICE PROVIDERS – Energy raters, renewable energy installers, green building specialists, architects, etc. tend to seek training and to be interested in advancing the state of the art.

TRAINERS – A number of trainers are operating in the state. Several observers noted the need for high quality training regardless of the source (e.g., utility, public institutions, private sector trade associations, unions, etc.).

UTILITIES – Directly offer extensive training and design assistance. They are aware of training resources. Can (if allowed by company policy) refer consumers to trained contractors. Utilities represent a fairly widely trusted source of consumer energy information. Several observers noted an important utility role in this area, particularly as a referral agent to certified products and services. One noted that "[utilities are the] prime actor because they are non-biased. They are not promoting any particular product and they are trusted."

The market actor network diagram for this initiative is shown in Figure 14 below:

Figure 14. Market Actor Network Diagram for Technical Training Grants

Market Barriers and Conditions that will Affect the Success of the Initiative

There are a number of market barriers and conditions that will affect the success of this initiative. These include:

Available funding. This initiative will not support itself in the short term and may need support until the consumer demand is strong.

Value of the skill: In the short term especially, there may be a condition in the market in which potential users of the training will need to be convinced that the training provides enough benefit that it is worth obtaining. This means that the value of the

skill demanded will need to be evident before a decision is made to obtain the skills. Training will not be sought until there is a strong benefit that can be captured immediately upon graduation or certification.

Low level of importance: While California has gone through a number of energy crisis conditions that have elevated the importance of energy efficiency, and the price of energy in California is among the highest in the United States, there is still a large portion of the building owner / manager community who do not consider energy costs to be a primary driver in making operational/facility decisions. This will affect the demand for these skills . However, more and more owners and managers are setting energy costs as a higher priority, potentially increasing demand for energy efficiency assessment and construction skills.

People interested in trades professions: There is a question if there are or will be enough people who are interested in the trades professions who will enter the energy efficiency assessment, installation and construction fields. Expert panel members indicated that there is a significant shortage of trades-skill associated people moving into the trades industry. This will need to be examined.

Receptiveness of Colleges: There is some question if the technical and community colleges are interested in developing expensive trade associated training programs without reliable “outside” financial help.

Weak mentoring systems: It was suggested that there are not enough mentors in the energy efficient construction and assessment field willing to take people under their wing and help them obtain the construction or assessment skills. It was suggested that training should also focus on how to spread skills across the firms and industry and how to build interest in assessments and construction approaches.

Book-based training is not as effective as hands-on training: Interviewees suggested that training within the building trades industry is more effective when hands-on instruction is provided. Students need to experience and practice the skills needed to design, construct and assess energy efficient building systems. However, hand-on training is more expensive to offer compared with book-based training such as math or history. Interviewees noted that training and certification efforts need to understand that visual and hands-on experience are effective training tools for this market even through those tools can be more expensive.

Established trades people may be reluctant to change practices: There is some concern in the market about the receptivity that the established trades industry (been in business for several years) will have to new training and certification initiatives unless they see a direct route to using the training and certification initiatives to their market advantage. It will be necessary to grow the market demand at the same time as the professional skills are being developed. Developing skills without a market demand for those skills will be a “non-starter” for the initiative.

Lack of confidence that a building-approach is better: While there seems to be agreement that customers understand that specific equipment can help save energy and lower bills, there is some suggestion that customers of homes and small commercial type structures may not believe there is enough potential to make the

building-level assessments worth the effort. A training and certification program may help build consumer confidence. However, some panel members were skeptical about whether a training program will affect consumer confidence, and suggested that consumer confidence would need to be addressed beyond training and certification efforts.

Lack of qualified professionals: There is general agreement among the interviewees and panel members that the trades industry has a significant lack of professionals who fully understand whole building assessment approaches and fewer still who know what to do to improve building-level performance. A training and certification program would be expected to increase the number of qualified professionals able to provide this service, especially in the nonresidential area.

Cost of services may be greater than market value: It was noted that for residential structures the cost of providing whole-house energy efficiency assessments is, for many customers, too expensive for the anticipated benefit. This was also noted for nonresidential customers. Training and certification efforts must be linked with market value efforts that educate owners about the potential benefits.

Shortage of skilled labor: Expert panel members indicated that there is a shortage of skilled labor in the equipment maintenance and energy equipment trades fields from which assessors might come, and suggested that training may help that shortage. They noted that people in this field are over-booked much of the year and are concerned with getting each job done as quickly as possible, potentially limiting the amount of effort that can be placed in an assessment without additional people in the field. Panel members noted that there are a significant number of untrained people working in the field and that training on energy systems is needed. A larger question, however, is whether firms will place their employees into the training efforts in this initiative.

Lack of knowledge of how to promote or sell energy efficient structures: Several interviewees suggested that the people who are in charge of building and selling energy efficient structures do not have the skill-sets associated with placing energy efficient structures in the market, developing a market message and positioning that message in the market, or dealing with the issues around the selling of these structures. While there are skilled people who can specify and build these structures, very few of these same people know how to position and sell the energy efficient structure. Experts suggested that training is needed on how to position and sell these structures and how to build market demand for energy efficient construction techniques.

Lack of rating knowledge for homebuilders: Interviewees suggested that many of the contractors building homes do not understand the rating principles and approaches. They are therefore less skilled at constructing a home that is specifically designed to acquire the highest energy ratings appropriate for the building and within the available budget. Training needs to help contractors understand the rating approach so that they can build to achieve the highest ratings.

Lack of time and money inhibit technical training potential: New builders entering the construction market are not skilled in the approaches for building energy efficient

structures. Interviewees noted that when construction is strong contactors do not have time for training, and when construction is slow they do not have the resources to obtain training. Interviewees noted that training needs to be applied when the market is slow and it needs to be easy and inexpensive to obtain. However, some interviewees suggested that training needs to be on-site in the environments in which the contractors work in order to be effective. If this is the case, training when conditions are slow may not be the right approach unless it can be conducted at a construction site.

Strategies for Overcoming These Barriers

Establishing, expanding or creating a new training effort for whole building energy assessments and energy efficient construction practices is not a simple task. It will require a strong steady funding stream to keep pace with the level of interest in entering the field and the needs of the field for trained professionals. Because the field may be somewhat transitory without strong profit margins, there may be an ongoing need for skill training unless profits are enough to keep people in the field. Unless the assessment and construction skills can provide a living for the students it will be rapidly abandoned and fail in the market. As a result, it will have to be coordinated with initiatives that build demand, so that there is demand for the training and it can be immediately applied. As a result, the initiative is challenging. It is essentially focused on trying to simultaneously strengthen skill levels and create demand for those skills to grow an industry focused on using less energy. There are organizations ready to help with training and certification efforts and there is a growing need for these skill sets as building energy efficiency requirements grow. In addition there is an indication that community colleges are ready to move back into the trades skills or strengthen their current trades programs.

Should there be related initiatives that make assessment mandatory, similar to the current approach for building sales inspections, the assessment industry will grow rapidly and there will be a shortage of people with the needed skill sets. As a result, it will be necessary to coordinate skill needs with the ability to obtain skills training.

Market Conditions that Support the Initiative

In addition, there are a number of market conditions that were identified during the research effort and support conditions. These include:

<u>Community and technical colleges have networks that can be used:</u> Interviewees suggested that California has a significant number of community and technical colleges that train students in trade industries and are in a good position to incorporate energy efficient construction techniques into their programs. As such they could be a valuable player in certification programs. However, there has also been a national movement of community colleges to serve more as two-year colleges focusing on getting students ready for a 4-year college or university program and colleges have moved away from the more expensive trades curriculums. However, community and technical colleges that have strong trades

programs may be well positioned to train students and to certify people for more advanced services where certification is an issue.

Trade associations can be allies and help: According to interviewees, California has a number of trade associations and industry allies that can be recruited to help grow a training and certification industry. Many programs have worked with these trade associations in the past and have established favorable contacts that can be used to help grow an initiative.

The current training programs can grow to meet need: California has a number of training efforts in operation. These have been provided by the utility companies for years and have effective approaches. Interviewees suggest that because of these past efforts, new more comprehensive efforts can be scaled up and implemented in a very short time. Interviewees suggested that training and certification programs can be developed, deployed and start showing results in just a couple of years. However, these same interviewees suggested that policy makers will need to understand the period of time it takes between training and applied skills in the market. It was suggested that about half of the trained individuals will apply that training in the market over the following years.

Current professionals are an incubator for advanced skills: It was noted by interviewees and panel members that the current auditing and assessment industry is ready to grow if demand exists. The basic skills are already present in the auditing and assessment community, and these skills can be developed through add-on initiatives that increase skill levels.

Contractors are looking for ways to differentiate themselves: According to some interviewees, contractors are looking for ways to differentiate their services in the market and give customers a reason for using their firms. The more market savvy contractors will see the energy efficient training and certification initiatives as a way to move above the pack, and attract more or higher-end customers.

Insurance industry may be supportive: There is some opinion that the building trades insurance industry may be supportive of a stronger trades training and certification initiative that focuses on building techniques that are safe and effective, which lowers risk for insuring individuals involved in providing these services.

Link to environmental issues can grow the market: It was suggested that training and certification initiatives need to be linked to environmental sentiments. Interviewees suggested that strong marketing efforts that creates demand using positive environmental messages will help the initiative.

Build confidence in ability to achieve impacts: There may be a lack of confidence on the part of building owners and operators who are skeptical of the level of expertise and potential impact to make whole building assessment approaches worth while. It was suggested that a strong training and certification program will build market confidence.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Interviewees suggested that both policy changes and legislation should be enacted to help move this initiative. These include:

- Legislating energy inspections and the quality of the inspections so that building buyers in California know what they are buying and also are advised on what they need to do to make there buildings energy efficient and cost effective.
- Legislation to require certification of building assessors.
- Policy changes to focus resources on providing training for building assessment and energy efficient installation and construction practices.

Potential for the Initiative to Achieve Market Penetration or Participation

Market penetration of energy efficient assessments is slowly increasing, for the most part, supported by public benefits funds. However, demand is low from a needs perspective. Likewise there is already a knowledge base within the construction industry and there are contactors and design professionals that know how to specify and construct energy efficient buildings even if they are few in numbers. . However, again, from a needs perspective, the demand for these services is not as strong as desired. There are hundreds of thousands of buildings in the market that are energy inefficient and add excessive demand to the energy infrastructure. While new construction is more efficient, there is a strong need to have current buildings become more efficient and to have strong energy efficiency perspectives built into construction training programs. It appears that even after more than 20 years of energy efficiency programs, making buildings more efficient is still the least cost approach for acquiring energy resources. Yet, the success of the training and certification initiative is grounded in the success of other initiatives designed to grow demand. If these other initiatives (presented in this report) are successful, demand for training and certification will grow.

The Energy Efficiency Choice Risk Protection Initiative

When interest groups are confronted with a choice concerning a selection of technologies that meet their needs, there is often a perceived risk of doing things differently than the ways that have worked in the past. This perception can be reinforced when individuals have to make changes to operational practices that have ended in unwanted results or results that did not meet expectations. When this occurs, individuals network the effects of the decision within their communication channels, building more market resistance to change. This initiative removes much of the perceived risk associated with the perception of making a poor decision by going with the energy efficient option. This initiative covers the cost of making a wrong energy efficient choice decision through the development of an optional risk protection component that can be added to technology incentive programs.

This initiative focuses on addressing three key participant barriers and two key product barriers that when combined, make up one of the most important barrier combinations in the market, limiting the adoption of energy efficient technology choice decisions. The five barriers include the participant barriers of risk avoidance, skepticism about benefits, and institutionalized procedures. The product barriers are reliability uncertainty and the barrier of performance uncertainty. These barriers build on each other and reinforce themselves and limit market movement toward the energy-efficient choice. This combination of barriers is among the most powerful influences in the market and significantly outweighs price considerations or payback periods, yet very few programs address these critical barriers independently and no programs address them as a combined effect. Yet, this barrier combination is real, it is strong, and it limits the energy efficiency of the economy. It is a missed opportunity.

One of the reasons why it is missed is a reluctance of energy professionals to want to enter into the risk assessment and risk protection arena. It is, in some ways, considered a part of the insurance industry or the product guarantee and liability field. These are areas in which energy efficient program managers feel uncomfortable and where some policy makers and regulators feel that energy programs should not go. As a result, the market is less efficient, and energy efficient choice decisions are abandoned for the comfort of doing things the way they have done things in the past.

There are several trigger events associated with this initiative. These include every time a product choice decision is made. In essence, it cuts across all trigger events, affecting all decision points in which an energy efficient choice is made or not made because of one or more of these barriers working in some combination. The pervasiveness of these barriers at almost every trigger point is significant. Yet there are no California initiatives to address this barrier. In fact, while research shows that this barrier combination is often more important than the price barrier, most of the initiative dollars in California go toward the price barrier and none are focused on

this combination of barriers. There have been no pilot programs addressing this combination of barriers and none are currently planned.

Energy Efficiency Choice Risk Protection

This part of the initiative discusses the establishment of a risk protection component to energy acquisition programs offered in California. The initiative consists of three parts. These include:

1. The formation of a risk assessment function that examines the operations of the market relative to the adoption of California incentives for energy efficient technologies. This risk assessment function examines the technology mix covered by the program offerings and determines per-participant-proportional cost of reducing the influence of this barrier combination on the available choice decision. This assessment will identify the financial risk associated with an energy efficient technology choice that does not perform to customer expectations. The initiative will need to determine what expectations are included and design the initiative around those characteristics. The expectations that have the greatest customer concern should be included.

Research shows that reliability is of great concern, as is the amount of down time experienced, and the effect on operations. Concerns about performance are critical: Is the product filling the purpose for which it was purchased or is the performance less than needed or expected? Some participants are concerned about energy cost savings, if they are in fact being realized. The assessment can examine the costs associated with the removal or repair of the technology and the cost of purchasing and installing the technology that would have been installed without the incentive program. This effort will also assess the risk of a product dissatisfaction decision in which the participant would want the new energy efficient equipment prepared to perform as intended, or removed and the alternative equipment placed in operation.

2. Once the risk factors are known or reasonably estimated, the initiative will identify a set of programs that can benefit from the risk reduction initiative. This assessment will examine the technologies covered in the program and the environments and use conditions in which those technologies will be placed. The initiative will then construct a set of technology-specific and program-specific risk cost estimates that allow for coverage of the cost to correct a poor technology choice made through program participation.

3. Next the program will develop a set of cost tables that will be used to drive program design decisions regarding how much of the risk cost should be carried by the initiative and how much should be carried by the participant. Options range from 100 percent of the cost of coverage by the initiative via public goods or procurement funds (or other funding option), to 100 percent coverage by the participant. This determination should be made only after steps 1 and 2 above are completed. If the costs are low, such that the programs can bear the cost and remain cost effective, program designers should consider having most or all of the cost covered by the initiative. If the costs are such that cost effectiveness is significantly harmed, the initiative can offer the risk protection as a customer-financed or partially financed option.

4. The initiative would then enter the design stage in which energy program designers and risk protection experts would determine the details of the designs for a pilot program. The pilot program would need to address operational issues as well as period of coverage issues and how costs will be covered or distributed across the various design options. The initiative will need to consider the following considerations:

- Arrangements with manufacturers, distributors, and dealers concerning decision criteria when the manufacturer's technology is at fault and when the participant's decision process or operating environment is at fault. Arrangements need to be made with these interest groups so that the initiative does not end up paying for technology problems that should be covered by the manufacturer, distributor or dealer.
- Decision criteria for when the energy acquisition program is, in part, at fault for offering incentives for poorly designed or manufactured technologies that should not be covered by the program or that are not designed to provide service in the customer's use or environmental conditions.
- The length of time the risk protection will be provided and the period of the time covered by the initiative. The initiative may need to cover one year via the program, then 50 percent the second year with coverage ending at the start of the third year. The initiative design process will need to work out coverage options and costs.
- A pilot program area will need to be defined. The area should be smaller than the state, but large enough to test the concept.
- Be open to help. There may be other collaborators that would like to join California in designing and testing this new initiative. California should be open to having design and pilot test partners from Wisconsin's Focus on Energy initiatives, from New York State Energy Research and Development Authority's (NYSERDA) public benefits program managers, and from Vermont's Energy Efficiency Utility. California may be able to share the program pilot costs to enable others to learn from the effort.
- Consider teaming with industry stakeholders who are already in the business or providing product guarantees and liability coverage. Or consider teaming with a new organization that is willing to take on this risk and develop this initiative to pilot in California.

5. Once the cost determination and allocation approach is determined, the initiative will design the appropriate materials and enrollment forms and processes to be used. The processes may need to offer the risk protection initiative as an option provided with the standard resource acquisition program offerings.

6. Appropriate marketing and information dissemination materials will need to be developed and incorporated into resource acquisition program delivery mechanisms. The initiative offering should also be included in with appropriate information and education programs so that the option is known in the market place beyond the program offerings with incentives.

The authors are sure that there are other aspects that will need to be addressed in the consideration and design development process. In addition, there will be issues that come up that may need to be addressed that are unknown at this time. Within the scope of this effort, we bring this significant barrier combination and initiative to the attention of California's policy makers for their consideration.

Importance of Initiative to California's Energy Supplies

As discussed earlier, this barrier combination is considered by many market researchers to be the single greatest barrier combination to the adoption of energy efficient technologies that reduce California's need for new power. Energy efficiency industry researchers have identified price barriers as explaining less than half of the market conditions limiting energy efficient technology adoption. Yet the current mix of energy acquisition programs focus almost exclusively on price reduction. No programs offer services that are designed to overcome the critical barrier combinations identified in this initiative description. It is reasonable to assume that if energy programs are successful (cost effective) at reducing price barriers to gain energy impacts, then there should be a significant level of success at increasing penetration by reducing more important barriers that limit technology use. In considering that this initiative can be structured to share the risk protection costs with the participant, there seems little technical reason not to test this concept.

Coordinating This Initiative with Other Interventions or Activities

The energy efficient choice protection initiative should be associated with several interventions or initiatives. These include:

- Information and education programs that need to incorporate information about this initiative in their efforts.
- Energy efficiency, procurement and demand reduction programs that will benefit from the inclusion of a risk protection component.

Organizations, Associations, and Stakeholders Affected by the Energy Efficient Choice Protection Initiative

This program, if successfully implemented, will have an effect across the market. As customers understand that they are not alone in the risks associated with their choice decisions, they will begin to minimize the risk associated with the barrier combinations addressed by this program.

- Policy makers may need to change policy provisions so that such a service can be allowed under the current program design and approval structures.
- Lawmakers may need to be consulted to determine how the initiative fits into current product liability and performance laws and support systems.
- Utility companies and third-party providers who would need to be consulted to arrange for the initiative to be incorporated into the program designs. This may

also involve legal staff that would need to be comfortable with the liabilities associated with the effort.

- Manufacturers, distributors, dealers and retailers whose product guarantees and/or liability coverage may be affected and need to be incorporated into the program design and coverage aspects.
- Contractors, dealers and retailers who would be expected to be the key delivery mechanism by which the remedies could be provided when a participant is negatively impacted by the choice decision.
- Industry associations or trade associations who are already involved in industry product support services that may have an interest in this initiative.
- Other energy program policy and design professionals in other states who may wish to join in the pilot development and testing of the initiative.

The market actor network diagram for this initiative is shown in Figure 15 below:

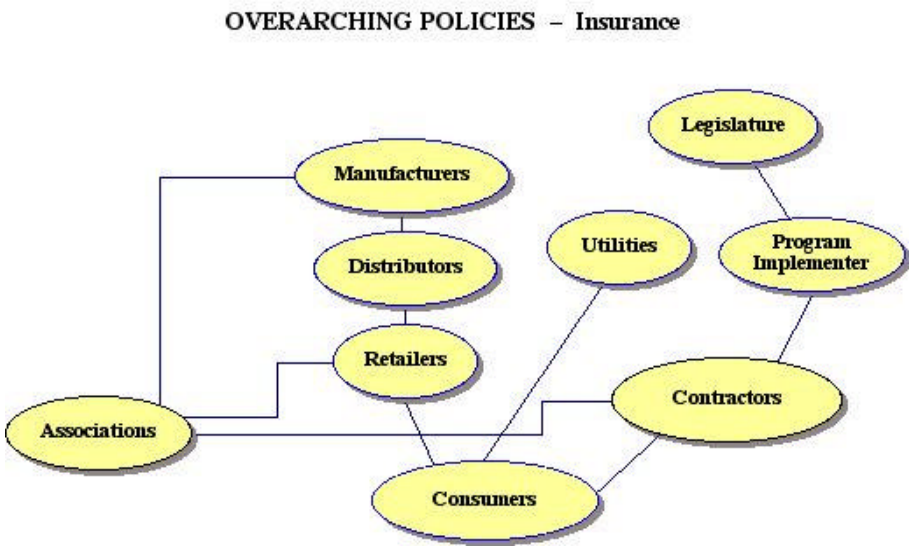


Figure 15. Market Actor Network Diagram for Energy Efficiency Choice Risk Protection Initiative

Market Conditions that will Affect the Success of the Initiative

There are a number of market conditions that will affect the success of this initiative. These include:

1. The ability of risk assessment professionals to accurately assess the risk involved and therefore set accurate initiative costs.

2. The ability of the initiative to convince potential participants that this initiative is able to overcome their risk aversions.

3. The ability of the initiative to work with stakeholders to create an initiative niche so that manufacturers, dealers, distributors, retailers and contractors are comfortable with the initiative.

4. The ability of the initiative to establish clear operational and coverage guidelines and decision criteria so that the program operates efficiently and participants understand the protection provided.

5. The ability of the initiative to be adequately field-tested so that reliable decisions can be made on the future of the initiative.

6. The ability of the State of California decision makers to support an initiative that is not a standard program component. It may be difficult for some state decision makers to support this concept for a number of reasons. This initiative is innovative and is may be considered too innovative or too risky for some.

Key Barriers Associated with the Success of the Initiative

There are a number of barriers to having a statewide coordinated energy efficient choice risk protection initiative that the program design will need to address. These include:

1. Market acceptance: There may be a market acceptance issue at first, that may or may not change over time. With this being a new initiative, this aspect will need to be monitored as the initiative is tested. If market acceptance is low and does not grow, this may limit the potential for the initiative.

2. Unknown participation-associated cost of the initiative: The cost of this initiative is not clear. While some similar initiatives have been placed in the market to cover guarantees of energy savings, they have focused on covering the cost of energy savings promised but not achieved, and have not focused on the ancillary costs associated with non-energy performance and satisfaction.

3. Unknown management and administrative costs: The amount of time this initiative will take from an internal operational perspective is not known. This initiative is likely to be more costly during the developing and testing phase and then move to more routine costs as the initiative matures.

4. Unknown market reaction: The reaction of the market stakeholders is another unknown. Like any new initiative, the initiative design and expected results are speculative during the discussion and concept sharing stage. How stakeholders will react to this initiative is not known at this time.

Strategies for Overcoming these Barriers

Reading the barriers listed above, they may seem too significant and leave the success of the initiative in doubt. This is a reasonable reaction to any new initiative. However, it should also be understood that these barriers are consistent with most new initiatives before they are developed and placed in the market. Some initiatives succeed and move the market toward higher energy efficiency. Others initiatives fail to reach a workable design or fail in the market when introduced. For this initiative,

additional research is required before decisions on its likely success can be made. For example:

1. This initiative should be presented and discussed in non-free rider participant and non-participant focus groups and tested in customer surveys and interviews to identify the demand that this initiative is expected to receive. These efforts should also collect program design and fielding concepts from the target markets.

2. If the market research indicates a positive response, the initiative should be discussed within industry stakeholder groups to gauge industry acceptance of the initiative. The results from the customer research should be shared with key stakeholders.

3. If industry support appears likely, the concept should enter the design stage where the cost assessments are conducted and the coverage areas and coverage conditions identified.

4. The initiative should then be pilot tested in a geographical area large enough to obtain and evaluate the results of the test initiatives. The pilot initiative should be modified during the test period to evolve the initiative to a near market read condition.

5. If the pilot program indicates market success can be expected, the initiative should be expanded to a larger region for full-scale implementation and testing. If this step is satisfactory it should be considered for statewide implementation.

These efforts will substantially reduce the risks associated with the barriers identified above, and if effectively developed and tested, may result in an initiative that expands the ability of resource acquisition programs to capture savings.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Legislation may not be the right approach to addressing this initiative unless that legislation says that the Energy Commission or the CPUC will investigate the potential for this initiative to improve program performance and participation. Beyond this aspect, the initiative should be handled as an internal area of investigation by establishing a policy to investigate the potential and conduct field tests to determine if there is a possibility of increasing the performance and participation of California's energy acquisition programs.

Potential for the Initiative to Achieve Market Penetration or Participation

The potential for this initiative to achieve market penetration is unknown at this time. What is known is that the barriers addressed through this initiative are substantial, and are typically more important than price. We also know that no programs offered in California address this barrier combination.

This is an initiative than needs to be assessed by professional market researchers. If the demand expected is real, it should be developed and tested to determine if the initiative has a place in the California program mix. We do not suggest that this initiative be considered at any specific product-design condition, but instead be examined from a number of design approaches. For example, customers could be given a choice of risk protection with each customer specifying the choice options that best fits their needs. A single option approach would not be focused on the market needs. In addition, the development of this initiative should not be overly influenced by those with opposing views, but instead be driven by real market data collected from the target population. The decisions associated with this initiative should be grounded on data that all stakeholders can examine rather than on assumptions about how the market may work relative to this initiative.

Inter-Agency Cross-Program Coordination

Sector; All sectors

Trigger event: Most all trigger events and on-going decision processes

Intervention type: Required and voluntary

This section discusses the potential to establish a statewide initiative within the current mix of programs focusing on the issue of inter-agency or cross-organizational program coordination and referrals. California's energy efficiency, demand reduction, and procurement programs have evolved into a fragmented mixture of services that are not consistent across the state and are now operating in a way that does not support strong cross-program coordination or referral mechanisms. It is highly possible and probable that program participants are not provided with information about other programs or energy-related services in which they are eligible to participant. These are lost opportunities.

At the current time there are several types of energy saving program administrative and implementation structures operating in California. Each of these types of structures is actively providing programs to the people of California. First there are the statewide energy efficiency programs. These programs offer services statewide and represent the backbone of the energy efficiency programs offered in California. Next, there are utility service territory programs that offer additional program services within each of the investor-owned service territories. Then there is the more localized set of third party programs that offer services within a single service territory or, more likely, within a small section of a service territory. Mixed in with this three-tiered approach are additional procurement and demand reduction efforts that can be implemented within one of the existing programs or as a stand-alone program. There seems to be reasonably good coordination across the statewide programs, and there seems to be reasonably good coordination between the utility territory programs and the statewide programs. However, there is limited coordination between the third party programs, the utility service territory, and the statewide programs. It is highly possible for participants in the third party programs

to take advantage of a specific program's offerings without being advised of the statewide, utility or other third party efforts that may be of interest to the participant. Likewise, there seems to be little coordination between the private sector initiatives that receive no energy efficiency funding, and the programs that are being offered in the state or local areas. There seems to be little or no formal system in place to capture program participation within the markets that have an interest in making their homes or buildings more energy efficient, especially across the private-public sector or between the third party programs and other initiatives.

Behavior research indicates that one of the best predictors of future participation is previous participation. That is, when a customer is pre disposed to seek help with their energy needs in one program, that same behavior applies to other services. If energy programs are not well coordinated with shared promotional materials and presentations of opportunities provided, substantial opportunities are missed. This condition should not be considered a sector-specific event. Participants in nonresidential (commercial-industrial-agricultural) programs are themselves residential customers. Every time a nonresidential program obtains a participant, they are obtaining the participation of a set of residential customers who, at the time of enrollment, are acting on behalf of their employer. Yet these people are seldom provided with information that applies to them as individual customers. Likewise, the residential program participant may be employed within a nonresidential sector business, but the residential customer is seldom provided with information that they can take to their employer for consideration.

These are obvious missed opportunities. However, there are even more serious missed opportunities. Participants in third party programs are often not provided with the materials and presentation tools that allow them to inform their participant of the other third party, utility, or statewide programs that are available to them. As one interviewee put it, "there is competition between the utilities and the third party programs, the system was established that way." This is in fact the case; the way in which program funding is allocated into the programs sets up a competitive environment that works against the goals of the funded initiatives. There is no formal way for programs to obtain funding for coordination, there is no formal way for programs to receive credit for referrals and there is no formal way for programs to receive energy impact credits for participants who are successfully referred to other services. The current approach actually harms the programs if they provide referral services or coordinate their services with other programs, unless the referral benefits the referring organization, or unless the referral is made by an information or education program that has no need for demonstrated energy impacts. However, even for the information and education programs, if program resources are consumed in the referral process, those dollars are not available for the function of the information and education program, unless that is the function of the program. The structure and operation of the evaluation effort actually compounds the problem. That is, the evaluation efforts are designed to give impact credit to the program and not to the way in which program participation is achieved. At this time, there are no evaluation efforts that look at what part of the program-induced impacts result from referrals or from cross-program coordination efforts. Evaluation budgets are low enough that many programs do not have the resources to provide reliable savings

estimates, let alone segregate estimates into what outreach, education or enrollment efforts are responsible for the impacts. Likewise, there is little structure in place for cross-administrator tracking system integration or information sharing. Participant databases are typically held by the program administrators or implementers and these organizations have little or no resources allocated to database sharing or participant information sharing across the services that are available.

In California, lost opportunities are a result of the way in which programs are structured, funded and administered, and the way in which program goals and goal accomplishments are counted and credited. Lost opportunities are designed into the system by default. However, with this said, we must also point out that some interviewees suggested that there are enough web sites and retail providers in the market that some coordination is already successful. Likewise, interviewees suggest that the CPUC is responsible for administrative coordination and that administrative coordination needs to be considered when developing a participant-based coordination initiative.

Interagency Cross-Program Coordination

This initiative focuses on establishing a system that recognizes and rewards information sharing and gives energy credits for that purpose. We suggest that no program implementation plan be accepted or approved for funding without a program information and coordination component. We also suggest that the responsibility for this initiative be assigned to an organization that is responsible for making sure energy supplies meet customer needs, that energy policy goals are met, determines who has the authority to approve program implementation plans and program funding streams, and determines who has responsibility for the evaluation planning and approval processes.

The initiative needs to focus on establishing processes, procedures, materials, and implementation and evaluation strategies and mechanisms that allow every participating nonresidential customer to be informed of the other programs and services that are available to them or to their employer. The participant is then free to distribute the materials to their employees or to not accept the offer of information. Likewise, every residential program needs to offer the participant information on the nonresidential services that are available to their employers. Residential customers can then decline the information if they do not want or need it.

The initiative should include an effort to guide the evaluation planning effort to identify how customers come into programs, and to give a portion of the energy savings credits to the efforts that caused that participation to occur. This is not to say that the energy acquisition, procurement or demand reduction programs should have savings taken away from them, as that would discount the importance of how the savings are achieved. However, this data is needed to drive the portfolio planning efforts. The evaluations should provide a distribution of impact credits across the efforts that caused the impacts to occur. An approach will need to be structured to accomplish this goal, but it could be accomplished by including questions in the customer contact efforts (surveys, interviews, etc.) across all evaluation efforts that

ask people how they heard about the programs and asks about involvement in other initiatives. Then the ratings can be structured to give credit to the efforts that drove participation consistent with the participant's accounts of the importance of those initiatives. Once designed, this would be easily and inexpensively incorporated into all impact evaluation efforts.

The CPUC should also adopt a policy that a fragmented, non-coordinated approach is unacceptable in California and require that programs receiving public goods or procurement funds must have a coordination component that accomplishes these goals. Another approach would be to have a single entity design the coordination materials and systems and have all impact programs use those systems. We do not attempt to design such a system in this research, but do bring this need to the attention of the Energy Commission, and emphasize the lost opportunities associated with the current program design, operational and evaluation structures.

In planning the coordination initiative the Energy Commission should consider both a dispatched coordination system in which all programs provide information and referrals and a system in which there is one central referral office with supporting databases and web structured systems and contact tracking systems. It may be possible to have all programs provide general referral information to customers and participants that focus not only on the participants, but their employers and neighbors, and then channel people into a central toll-free call center or internet site with tracking software attached to the referral service.

Importance of Initiative to California's Energy Supplies

California offers more programs to more customers, covers more technologies, and provides more information on energy efficiency than any other state. More than any other state, California needs to have a coordinated delivery mechanism to be able to capture the opportunities associated with participation and be able to recognize and reward good implementation and coordination practices. When participants are not informed of the other opportunities that are available to them, that lost opportunity must be captured in new power plant construction and greater levels of emissions and associated effects.

Coordinating this Initiative with Other Interventions or Activities

This initiative can be coordinated with many programs and organizations. These include:

- The CPUC that must oversee and order the implementation of this initiative, including both the program coordination and the evaluation and tracking efforts.
- The Energy Commission has expertise that can inform the initiative design efforts and perhaps help develop the operational designs of the initiative.
- The program administrators who are responsible for program design, development and implementation.

- The statewide and utility energy efficiency programs that will likely benefit from the effort through referrals, but who also must refer participants to other programs.
- The third party program administrators that will refer participants to other programs, but who will also experience referrals.
- The evaluation contractors who must modify program-based evaluations to recognize the contributions of other programs, referral systems and information providers.

The tables presented at the end of the section present the PGC programs that will need to be incorporated into the coordination effort. These programs, plus the Energy Commission's programs, and the procurement and demand reduction programs make up the vast majority of the programs that should be included in the coordination effort. The development of this initiative needs to be coordinated with the CPUC's Energy Division staff, the Energy Commission's program administrators and managers, the utility staff and the third party program administrators. In addition, the CPUC will need to coordinate the impact evaluation efforts to document effects of the coordination initiative. It is also likely that this initiative will need to be coordinated with program-specific tracking system administrators and technical staff to ensure that tracking systems are modified to identify when coordination efforts have been provided at the participant level. There also may be a need for professional energy program providers to be involved in addressing how the initiative can best be incorporated into the program delivery efforts.

To inform the design and development of this initiative, the Energy Commission is referred to the October 30, 2002 and the June 2004 reports on the consolidation of evaluations of energy efficiency program evaluations. These reports group programs by the similarity of their implementation components and identify programs in which the evaluation efforts could be consolidated. These reports, while dealing only with the evaluation component, provide an assessment of the programs with characteristics that should be considered in designing the coordination initiative.

Organizations, Associations, and Stakeholders Affected by the Inter-Agency Coordination Initiative

This initiative primarily affects the organizations directly associated with the development and delivery of energy services in California. These organizations are discussed above. This initiative involves few other organizations and is primarily an initiative that is internal to the program environment.

The market actor network diagram for this initiative is shown in Figure 16 below:

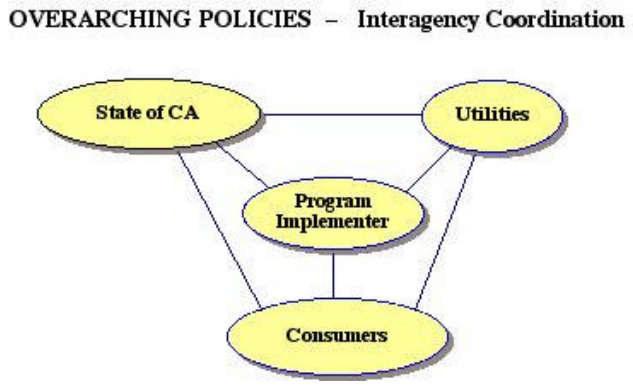


Figure 16. Market Actor Network Diagram for Interagency Coordination

Market Conditions that will Affect the Success of the Initiative

There are few market conditions that will affect the success of this initiative. These include:

1. The program implementation and administration organizations will need to embrace the concept behind the initiative and support the intent and methods developed for the delivery of the effort. If the implementers and administrators do not embrace and follow through with the efforts in a way that successfully implements the strategies, the effort will only partially succeed.

2. The CPUC and the Energy Commission will need to actively and visibly support the initiative to send a clear message that these efforts will be a successful part of the California portfolio.

3. Program vendors and stakeholders will be affected in that they will find their program-related services in stronger demand than without the initiative. However, the demand will not be strong across all programs. Those program services that lend themselves to referral services will be most affected.

Key Barriers Associated with the Success of the Initiative and Strategies for Overcoming these Barriers

There are a number of barriers to having a statewide program coordination initiative that will need to be addressed. These include:

1. Short planning period does not allow for coordination planning: Interviewees suggested that administrators are asked to put their programs together in a very short period of time, requiring them to forgo complicated or unnecessary program design efforts that do not fit within the available timeline.

2. Budgets are negotiated down during review: During the program review and approval process, budgets are not increased to allow elective tasks, but rather are negotiated down, asking administrators to get rid of tasks that are considered not

essential to the specific program being planned. As such there is only limited funding for best-practice non-essential approaches such as inter-program coordination.

3. Not a valued item in current process: Interviewees report that coordination is not seen as a valued item in the current design and approval process. While many policy staff and administrators have discussed its importance, it is not seen as a critical path item.

4. No incentive for cooperation: There is currently no way for administrators to be rewarded for coordination efforts. It detracts from the tasks that are required to obtain participant impacts. Without an incentive making coordination an income-stream item, there is little incentive to devote resources to this effort.

5. Energy savings not credited: Interviewees report that not only is coordination not valued, programs that do provide effective coordination are not given energy credits for the results of their efforts. If you cannot count energy savings that result from coordination efforts, and the rewards go to another organization, there is little perceived benefit.

6. Information system and materials lacking: Programs, program referral information, and referral materials are not set up in the fragmented program approach that is currently employed. There is currently no information system that supports a geographical, sector, or participant based coordination approach. Information systems will need to be established and maintained and the appropriate referral materials will need to be designed, developed and fielded in a way that allows easy error-free referral services to be provided. The system will need to be structured so that participants that are only eligible for one program are not referred to another. Likewise, the system must allow referrals when participants are eligible for additional services. In addition, climate zones may require that coordination be filtered through a climate zone check to make sure that eligible customers are referred to programs that have services that apply to the climate zone in which they live.

7. May be more expensive than benefits suggest: Interviewees suggested that the benefits from a strong coordination effort may not be worth the additional energy savings that could be achieved. It would have to be somewhat inexpensive to provide. The benefit cost ratio of the coordination effort would have to be carefully studied before the effort was seriously considered. However, interviewees also suggested that if customers heard a clear and consistent message across all the programs and program providers, the customer is more likely to be convinced to take actions and that the need is real.

8. Conflicting program cycles: Interviewees suggested that the CPUC's program cycle conflicts with administrator planning cycles and that the various planning cycles need to be coordinated to achieve a participant-based coordination effort. When programs are planned at different times, the coordination initiative needs to be sensitive to these timelines.

9. Competitive nature of funding access: Interviewees indicated that under the current administrative approach, organizations are placed in a competitive

environment for limited funds. Organizations must compete for funding in a way that requires administrators to prove that their programs are better than others. This builds competition among the program providers and acts to limit cooperation. When administrators are asked to coordinate across programs and providers they interpret this request as providing information that would aid their competitors.

10. Some administrators may resist: Competition for funding may not be the only barrier that pits administrators against one another. There may be some administrators that will resist a strong participant-based referral system that routes customers into organizations that they would prefer their customers/participants not to go. This may be especially important in view that program administrators must compete with other potential providers for service image, seeing a need to make other providers look bad or themselves look good. In competitive environments there is often the view that "all our services are the best there is in the market because we are the best provider in the market." Or there may be the perspective that, "our customers should come to us for their energy needs, that's what we do, we are not in the business of showing our customer the front door of other organizations." Some may view this as feeding the enemy.

Strategies for Overcoming These Barriers

While these barriers seem significant, they may not be substantial from an implementation perspective if there can be general agreement on the need for and the structure of a referral system. There are ways that should be considered that could, for example, employ central referral mechanisms that also act as central information clearing houses making the effort simple and manageable.

These barriers may also be addressed via CPUC orders pertaining to how program proposals should be provided, specifying a referral approach that needs to be included in program proposals. However, the barrier about the energy savings not being worth the cost needs to be more aggressively assessed. This assessment should examine the program mix and the delivery areas in which a coordinated referral system can refer the right people to the right program. Likewise, the CPUC and the Energy Commission should assess the potential to improve energy savings by specifying the type of programs that should be solicited within specific geographic areas to maximize referral potential within the portfolio without damaging program-specific savings. The Energy Commission and the CPUC should not rely on proposals to determine what programs to offer, but set program offering requirements and have vendors bid to those requirements, including referral requirements. The key will be to establish a system that is not threatening to the users, does not cost the users significant time or effort, can sort through customers and participants by location and link location and customer type to program offerings, and do so in a way that tracks referrals. Likewise, the evaluation effort will need to be structured to plan referral assessments of impact to give credit where credit is due.

These efforts will substantially reduce the barriers identified above and if effectively implemented will allow the initiative to succeed and grow in its impacts.

Market Conditions that Support the Initiative

In addition, there are a number of market conditions that were identified during the research effort that have been identified as conditions that may support the operations of this initiative. These include:

1. Utility efforts are already coordinated: The utilities now implementing efficiency programs are already coordinating their program services with the statewide efforts and are used to using referrals and coordination approaches. Interviewees report that when the utilities were responsible for program design and implementation, they routinely coordinated services at the participant level. As a result, many administrators are already on board and familiar with a coordinated, participant-focused approach.

2. CPUC is responsible for administration coordination: The CPUC now has program administrative coordination responsibilities. This structure can be used to promulgate referral rules and approaches to programs, should such a referral initiative be developed.

3. The program implementation plan (PIP) process can include the requirement: The current program implementation planning system can be modified to include performance to an agreed upon approach. Program implementation plans can then be designed to deliver on that approach.

Legislation or Policy Considerations that can Influence the Success of the Initiative

Interviewees suggested that policy changes would help establish and launch the initiative, but suggested that legislation should not be enacted to help move this initiative forward. If legislation is provided, then the initiative is tied in the legislative knot that is hard to untie if the initiative does not work out well. This may be best set through policy decisions or Administrative Law Judge orders.

Potential for the Initiative to Achieve Market Penetration or Participation

This aspect needs more in-depth research than what is available through this effort. However, behavior science is clear on this issue, and previous evaluations have shown participation is the best predictor of future participation. Those that participate in one program are the very people who are most likely to participate in others. If there are other programs that can benefit the participant, this initiative should do very well and capture repeat participants. The key to this assessment rests in the program offerings that are provided and the need of the participant. Likewise, if programs can be tailored so that offerings are complementary the initiative should succeed. On the other hand, if program offerings are more comprehensive, the initiative may not be of significant value.

The following tables are provided so that the Energy Commission can see the types of programs currently being offered.

Table 1. Utility Programs

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Southern California Edison (SCE) – Pump Test and Hydraulic Services	Agricultural	SCE	Utility service territory	Pumping
Pacific Gas & Electric Company (PG&E) Pacific Energy Center	Commercial	PG&E	Utility service territory	Air conditioning and heat pumps, Comprehensive, Interior and exterior lighting
Pacific Gas & Electric Company (PG&E) Local Crosscutting Food Service Technology Center	Commercial	PG&E	Utility service territory	Food service technologies, Commercial kitchen ventilation, Spray heads (dish washing)
Silicon Valley Partnership	Commercial	PG&E	Bay area	CFLs, Comprehensive, Interior lighting, Cool roof
Southern California Edison (SCE) Local Small Nonresidential Hard to Reach Program	Commercial	SCE	Utility service territory	Air conditioning tune-ups, Air conditioning and heat pumps, CFLs, Interior lighting, Thermostats, Windows
San Diego Gas & Electric Company (SDG&E) Local Nonresidential Small Business Energy Efficiency	Commercial	SDG&E	Utility service territory	CFLs, Interior lighting, Occupancy sensors
The Energy Coalition	Cross-cutting	SCE	Southern California	CFLs, Thermostats, Comprehensive
PG&E Local Government Partnership: City of West Sacramento	Cross-cutting	PG&E	West Sacramento	Comprehensive
The Energy Coalition: Community Energy Partnership - SCG	Cross-cutting	SCG	Southern California	Comprehensive
East Bay Partnership	Cross-cutting	PG&E	Bay Area	Comprehensive

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Bakersfield/Kern Energy Watch	Cross-cutting	PG&E, SCE, SCG	Central valley	Central air conditioning, CFLs, Insulation, Thermostats, Water conservation measures, Windows; Air conditioning tune-ups, Air conditioning and heat pumps, Boilers, Interior lighting, Occupancy sensors, Water heaters
Nonresidential Financial Incentives	Cross-cutting	SCG	Utility service territory	Food service technologies, Furnaces, Waste heat recovery systems, Kilns, Processes optimization
Southern California Edison (SCE) – Local Government Initiative Program	Cross-cutting	SCE	Utility service territory	Comprehensive
LA County / SCE / SCG Partnership	Cross-cutting	SCE, SCG	LA County	Window air conditioning, Appliances, CFLs, Lighting controls, Boilers, Building Commissioning, Chillers, Interior and exterior lighting, Timers and time clocks, Water heaters
Schools Resource Program	Institutional	PG&E	Utility service territory	Comprehensive
Energenius	Institutional	PG&E	Utility service territory	CFLs, Comprehensive
Local Residential Lighting Turn-in	Residential	SDG&E	Utility service territory	CFLs, Torchieres

Table 2. Statewide Programs

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Statewide Nonresidential Energy Audit Program	Commercial	PG&E, SCE, SDG&E, SCG	Utility service territory	Comprehensive
Upstream HVAC and Motors	Cross-cutting	PG&E, SCE, SDG&E	Utility service territory	Air conditioning and heat pumps, Chillers, Motors
Statewide Standard Performance Contract	Cross-cutting	PG&E, SCE, SDG&E	Statewide	Comprehensive
Statewide Energy Efficiency Education and Training Program	Cross-cutting	PG&E, SCE, SDG&E, SCG	Statewide	Comprehensive
Statewide Building Operator Certification and Training Program	Cross-cutting	PG&E, SCE, SDG&E, SCG	Utility service territory	Comprehensive
Emerging Technologies	Cross-cutting	PG&E, SCE, SDG&E, SCG	Utility service territory	Emerging technologies
Savings by Design	Cross-cutting	PG&E, SCE, SDG&E, SCG	Statewide	Comprehensive, Processes optimization, refrigeration
Statewide Nonresidential Express Efficiency	Cross-cutting	PG&E, SCE, SDG&E, SCG	Utility service territory	Air conditioning and heat pumps, Boilers, CFLs, Chillers, Clothes washing Condensers, Daylighting controls, Food service technologies, Interior and exterior lighting, Motors, Occupancy sensors, Refrigeration, Timers and time clocks, Variable speed drives, Vending machines, Water heater, Windows
Statewide Crosscutting Codes and Standards Advocacy Program	Cross-cutting	PG&E, SCE, SDG&E, SCG	Statewide	Comprehensive
IOU/UC/CSU Partnership (Statewide)	Institutional	PG&E, SCE, SDG&E, SCG	Statewide	Building Commissioning, CFLs, Chillers, Interior and exterior lighting, Motors, Cooling towers, Timers and time clocks

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Statewide Appliance Recycling	Residential	PG&E, SCE, SDG&E, SCG	Statewide	Recycling appliances
Statewide Single Family Energy Efficiency Rebate	Residential	PG&E, SCE, SDG&E, SCG	Statewide	Central and window air conditioning, Appliances, Ceiling fans, CFLs, Duct leakage sealing, Envelope tightening, Furnaces, Insulation, Interior lighting, Whole house fans, Swimming pool pumps and covers, Thermostats, Torchieres, Windows
Statewide Residential Retrofit Home Energy Efficiency Survey Program	Residential	PG&E, SCE, SDG&E, SCG	Statewide	Comprehensive
Statewide Multifamily Energy Efficiency Rebates	Residential	PG&E, SCE, SDG&E, SCG	Statewide	Central air conditioning, Appliances, Ceiling fans, CFLs, Comprehensive, Furnaces, Interior and exterior lighting, Exit signs, Lighting controls, Photocells, Thermostats, Water conservation measures, Water heater replacement, Windows
Statewide California Energy Star New Homes Program - Single Family, Multifamily	Residential	PG&E, SCE, SDG&E, SCG	Statewide	Education and Training

Table 3. Non-Utility Programs

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
CA Multi-Measure Farm Program	Agricultural	PG&E, SCE	Utility service territory	Efficient compressors, Heat recovery, Variable speed drives
Agricultural Pumping Efficiency	Agricultural	PG&E, SCE, SCG	Utility service territory	Pumping
Certified Organic Farmer EE Program	Agricultural	PG&E	Northern California	Motors, Air conditioning, Interior and exterior lighting, Fans, Food processing, Refrigeration, Pumping
Energy Savers Program	Commercial	PG&E	Northern California	Air conditioning tune-ups, Air conditioning and heat pumps, CFLs, Interior lighting, Thermostat
Energy Savers Program	Commercial	SCE	Southern California	Air conditioning tune-ups, Air conditioning and heat pumps, CFLs, Interior lighting, Thermostat
Mobile Energy Clinic	Commercial	SCE, SDG&E, SCG	Utility service territory	Air conditioning - tune-ups, CFLs, Pipe insulation, Water heater controls, Refrigeration
Building Tune-Up Program	Commercial	PG&E, SCE	Utility service territory	Building Commissioning, Comprehensive
Pre-Rinse Spray Valve Installation Program	Commercial	PG&E, SCG	Utility service territory	Spray heads (dish washing)
Non Res Fenestration Certification Initiative	Commercial	PG&E, SCE, SDG&E, SCG	Statewide	Windows
EEGOV Business Energy Services Team	Commercial	PG&E, SCE	Other - cities to be identified during course of program	CFLs, Interior lighting, Occupancy sensors, Refrigeration, Thermostat, Vending machines, Windows
Business Energy Services Team (BEST)	Commercial	SDG&E	Other - Greater San Diego	CFLs, Interior lighting, Occupancy sensors, Refrigeration, Thermostat, Vending machines, Windows

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Enhanced Automation Initiative	Commercial	PG&E, SCE	Utility service territory	Building Commissioning, EMS
Energy Smart Grocer	Commercial	PG&E, SCE, SDG&E	Statewide	Building Commissioning, Food service technologies, Motors, Custom measures, Refrigeration, Variable speed drives
Green Action Program	Commercial	SDG&E	Utility service territory	Interior lighting
"Emerging Communities Energy Efficiency Program"	Commercial	PG&E, SCE	Utility service territory	Air conditioning tune-ups, Food service technologies, Interior and exterior lighting, Occupancy sensors, Reflective window film, Refrigeration, Thermostats
Sm Non Res Energy Fitness Program	Commercial	PG&E	Northern California	Air conditioning tune-ups, CFLs, Interior lighting, Occupancy sensors, Thermostats, Vending machines
San Joaquin Comprehensive EE Program	Commercial	PG&E	Central valley	Air conditioning and heat pumps, CFLs, Food service technologies, Duct leakage sealing, Interior and exterior lighting, Refrigeration, Water heater, Windows
Green Campus Pilot Program	Commercial	PG&E, SCE, SDG&E	Statewide	
RightLights	Commercial	PG&E	Central coast	CFLs, Daylighting controls, Interior lighting, Spray heads (dish washing)
Yolo Energy Efficiency Project-1	Cross-cutting	PG&E	Yolo County	Torchieres, Shade screens, Evaporative Coolers, CFLs, Internal and external lighting

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Efficiency on Wheels	Cross-cutting	PG&E	San Francisco	CFLs, Envelope tightening, Occupancy sensors, Power strips, Thermostats, Water conservation measures, Vending machines
Northern California Local Government Energy Partnership	Cross-cutting	SCE	Northern California	
City of Fresno Partnership	Cross-cutting	PG&E	City of Fresno	Comprehensive
Positive Energy Loan Fund	Cross-cutting	SCE	Utility service territory	Comprehensive
PG&E Local Government Partnership: El Dorado County	Cross-cutting	PG&E	El Dorado County, City of Placerville	Comprehensive
City of Stockton Partnership	Cross-cutting	PG&E	City of Stockton	Comprehensive
Yolo Energy Efficiency Project-2	Cross-cutting	PG&E	Yolo County	Evaporative Cooling
LIghtWash	Cross-cutting	PG&E	Bay area, Central Valley	Appliances, Water heater replacement, Clothes washing, Interior lighting
Prototype Community EE Program	Cross-cutting	PG&E, SCE	SCE and PGE service territory	Comprehensive
Green Building Education and Technical Assistance Program	Cross-cutting	SDG&E	Utility service territory	Comprehensive
Local Government Program	Cross-cutting	SDG&E	Utility service territory	Comprehensive, Energy Information Systems
San Diego Energy Resource Center	Cross-cutting	SDG&E	Statewide	Comprehensive
SDREP Technical Assistance Program	Cross-cutting	SDG&E	Greater San Diego	Air conditioning and heat pumps, Boilers, Building Commissioning, Chillers, Insulation, Interior and exterior lighting, Motors, Occupancy sensors, Variable speed drives, Windows, Compressed air systems, Energy Management Control System, Motors

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
San Diego Regional Cool Communities Shade Tree	Cross-cutting	SDG&E	Utility service territory	Trees
Residential Duct Services	Cross-cutting	SCE, SCG	Southern California - Inland	Air conditioning tune-ups, CFLs, Duct leakage sealing, Water conservation measures
City of Pomona and Southern California Edison Partnership for Energy Efficiency	Cross-cutting	SCE	City of Pomona	Air conditioning and heat pumps, Comprehensive, Interior lighting, LED Lighting, Pedestrian, Window film
CLEO	Cross-cutting	PG&E	Targeted in high Chinese population areas	CFLs, Energy Star Appliance, Torchieres
Retro commissioning	Cross-cutting	PG&E, SCE, SDG&E	Statewide	
RCA Verification for New AC Program	Cross-cutting	PG&E, SCE	Statewide	Air conditioning verifications
Ventura REA	Cross-cutting	SCE, SCG	Ventura County	Comprehensive
South Bay Cities Energy Efficiency Center	Cross-cutting	SCE, SCG	South Bay	Comprehensive
Redwood Coast Regional Comprehensive Energy Information and Education	Cross-cutting	PG&E	Northern California, Humboldt County	Comprehensive
Green Schools	Cross-cutting	PG&E, SCE	Northern California	Comprehensive
San Diego Green Schools	Cross-cutting	SDG&E	Utility service territory	Comprehensive
Marin Public Facilities Energy Management Team	Cross-cutting	PG&E	Marin County	
CA Wastewater Process Optimization	Industrial	PG&E, SDG&E	Utility service territory	Motors, Processes optimization, Variable speed drives, Waste water
Compressed Air Management Program	Industrial	PG&E	Utility service territory	Compressed air systems, Variable speed drives
Designed for comfort, Efficient Affordable Housing	Institutional	SCE, SDG&E, SCG	Statewide	Comprehensive

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Statewide School Energy Efficiency	Institutional	PG&E	Utility service territory	Air conditioning and heat pumps, CFLs, Chillers, Daylighting controls, EMS, Lighting exterior, Interior lighting, Occupancy sensors, Water conservation measures, Windows
San Diego City Schools Retrofit and Partnership Program	Institutional	SDG&E	Utility service territory	Comprehensive
Performance Home Certification and Whole House Energy System Services	Residential	SCE	Southern California Inland (San Gabriel Valle, Inland Empire, High Desert, Low Desert) Utility service territory	Air conditioning tune-ups, Central air conditioning, CFLs, Duct leakage sealing, Envelope tightening, Insulation, Water heater & pipe insulation, Thermostats, Water conservation measures
Home Energy Efficiency Design-PG&E &SDG&E	Residential	PG&E, SDG&E	Statewide, Utility Service territory	Comprehensive
Moderate Income Comprehensive Attic	Residential	SCE		Duct leakage sealing, Air conditioning tune-ups, Water conservation measures, Insulation, CFLs, Thermostats, Water heater & pipe insulation, Torchieres
Moderate Income Comprehensive Attic	Residential	SCE	Utility service territory	Duct leakage sealing, Air conditioning tune-ups, Water conservation measures, Insulation, CFLs, Thermostats, Water heater & pipe insulation, Torchieres
Community Energy Efficiency Program	Residential	PG&E	Utility service territory	Comprehensive
Building Energy Code Training	Residential	PG&E, SCE, SDG&E	Utility service territory	Comprehensive

Program Title	Market Segment	Utility Territories	Geographic Area	Technologies
Partnership for Energy Affordable MF Housing	Residential	PG&E	Targeted at Bay Area specifically the Central Valley in the PG&E service territory	Comprehensive
Comprehensive HTR Mobile Home Program	Residential	SCE, SCG	Utility service territory	Air conditioning tune-ups, CFL's, Comprehensive, Duct leakage sealing, Water conservation measures, water heating controls
The Gas-Only Multifamily Program	Residential	SCG	Gas customers NOT located in an IOU service territory, Utility service territory	Appliances, Insulation, Water heater replacement and controls
CA Retrofit Home Performance Program	Residential	PG&E	Central valley	Comprehensive
Green Building Tech Support	Residential	PG&E	Utility service territory	Comprehensive
CA Youth Energy Services	Residential	PG&E	Berkeley, Oakland, Emeryville, Richmond, and El Cerrito	CFLs, Water heater & pipe insulation, Clotheslines, Thermostats, Water conservation measures

5. ELECTRICITY, NATURAL GAS AND PEAK SAVINGS POTENTIAL

The electricity, natural gas and peak demand savings potential of the interventions considered in the project are calculated from a combination of the technical potential of a particular technology to save energy and the role of the intervention in improving the adoption of the technology. The technical potential calculations consider the building type, existing building stock, the energy savings potential of a set of technologies targeted under the intervention, the saturation of equipment types in the general population and the frequency with which the target population comes in contact with a particular intervention. The adoption model considers the ability of the intervention to address barriers that influence the technology adoption process. The overall process is shown in Figure 17 below:

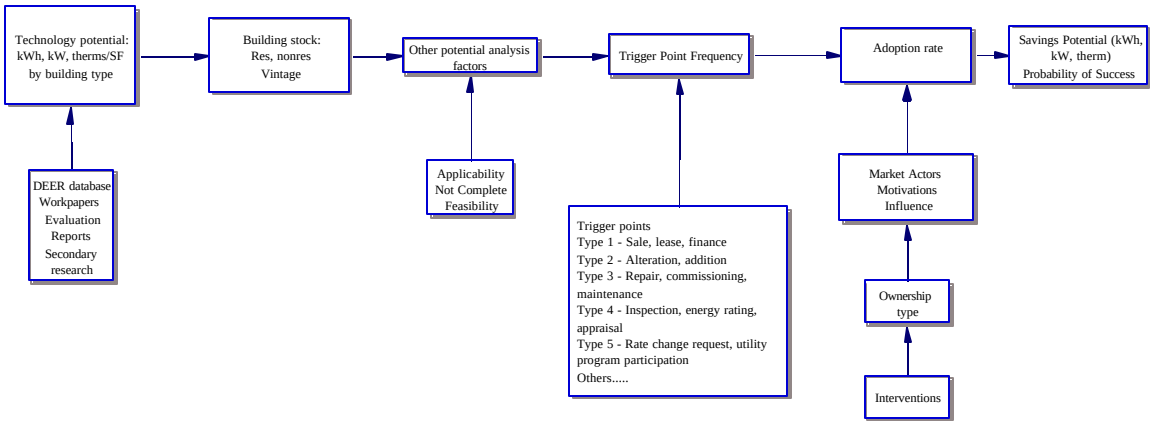


Figure 17. Energy Savings Potential Process

Technical Potential

The technical potential calculations follow the model used by Xenergy (2002) for a series of potential studies conducted for existing residential and commercial buildings. Technical potential is defined as the energy savings resulting from complete penetration of all measures in applications where they are deemed technically feasible from an engineering perspective. The overall technical adoption model is shown in Equation 1 below:

Equation 1

$$Technical\ \ potential = Building\ \ stock \times EUI \times F_{savings} \times F_{applicabilty} \times F_{feasibility} \times F_{not\ complete}$$

where:

Technical potential	= technical savings potential in GWh, MW or Mtherm
Building stock	= existing building stock by building type. These data are generally expressed in terms of number of homes for residential buildings or building floor area for commercial buildings
EUI	= energy use intensity for the building type and end-use affected by the efficient technology, defined with units consistent with the building stock data (e.g. kWh/SF or therm/home)
$F_{savings}$	= savings factor, which is the end-use savings fraction associated with the efficient technology
$F_{applicability}$	= applicability factor which is the fraction of the floor space that applies to the efficient technology by building type. For example, the applicability factor for an efficient air conditioner would be equal to the fraction of the floor space that is served by air conditioning
$F_{feasibility}$	= feasibility factor, which is the fraction of the floor space where it is technically feasible to convert from standard to efficient technology
$F_{incomplete}$	= incomplete factor, which is the fraction of the floor space that has not been converted to the efficient technology

Data on existing building stock floor area, end-use intensity, savings factor, applicability factor, feasibility factor, and the incomplete factor were gleaned primarily from the Xenergy Statewide Energy Efficiency Potential Studies for residential and commercial buildings. These data were supplemented with additional data collected during the research conducted for the AB 549 project.

The Market Adoption Model

Market barriers function within the confines of an adoption process. Over the years several models of the adoption process have been developed. However, one seems to have emerged as the dominant model in which most market research is supported. This model is called the “diffusion of innovation” model developed by E. Rogers (1995). [6] This model (Figure 18) contains five steps that technology adopters

[6] Everett Rogers, The Diffusion of Innovation, The Free Press, 1995.

move through as they are exposed and act to acquire and use new technologies or concepts that are placed in the market.

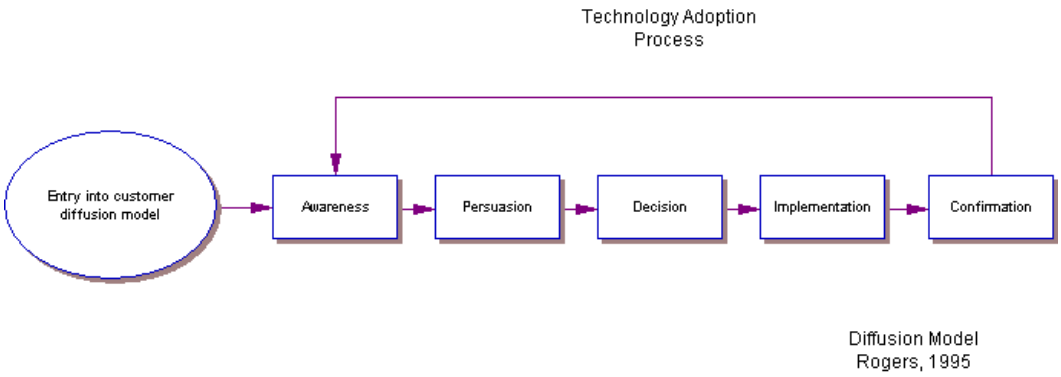


Figure 18. The Technology Diffusion Model

The first step in the product adoption process is to become aware of a product or service. Unless a customer is aware of the product, there is no market potential for that product. Product marketing efforts often focus on making people aware of products and services before they provide details concerning the product's benefits or costs.

After a customer is aware of a product, the customer must then gain enough information about the product to be convinced that it is something they should consider. This is different than the decision that they should try it. Customers must first be persuaded to consider the product; this is called the persuasion stage. Marketing efforts that trumpet the characteristics of a product are designed to persuade customers that the product has unique advantages and should be considered over other products that may not have these advantages.

Once a customer is persuaded to consider the product, they go into the decision stage during which they will make a decision to try or not try the product. This is a critical point in the process and can end in a decision to not try a product more often than a decision to try the product. In this stage the customer considers the information gained during the persuasion stage and brings that information into a decision process. Sometimes the process is simple and is made after minimum information collection or exposure. In other cases, the decision process can be complex and take several years. If the customer decides not to try a product they can end all future consideration for a product. They may also decide to go back into the information gathering stage (persuasion) or the decision stage at a later date when the technology is better, cheaper, or when the customer's budget or planning process allows for reconsideration.

If the customer makes a decision to try a product, the customer then moves to the implementation stage. Again, this stage can be accomplished quickly, or can take several years.

Once the decision to buy a product is implemented (purchased, installed and used) the adopter moves to the confirmation stage. In this stage the adopter evaluates his/her experience with the product and confirms that the decision was good and bears repeating or determines that their experience with the product was negative and decides not to repeat the decision. This last stage is one of the most important stages, and is the least considered in the energy efficiency program implementation process. If adopters are not satisfied with their decisions they will network this dissatisfaction in the market, making it extremely difficult to overcome market resistance. On the other hand, if they are satisfied, and the product, the provider and the performance all are satisfactory, this networking can also help substantially speed adoption. However, the speed of adoption depends to a large degree on a different set of product criteria.

Factors Affecting Speed of Adoption

There are a variety of factors that influence the rate of adoption of innovations that have a strong similarity to, and are linked with, market barriers. The rate of adoption of a product or innovation is often dependant on several conditions including the barriers discussed above and of course, by the type and structure of the promotion systems. But often energy program designers need to consider that the primary driver of adoption, beyond those items discussed above, is the nature of the communication system, and system networks and communication channels used to communicate.

A careful reading of the diffusion of innovation literature makes it clear that market barriers are not just "out there dangling in the market ready to be addressed" but may be triggered by the innovation itself. The nature or perceived nature of a product or service contributes to whether, and how quickly, it is adopted. The market research literature identifies five key attributes of products or services that drive the speed of adoption. These are very closely aligned with the barriers identified and discussed earlier and are worth briefly discussing here. These include:

1. Relative advantage (for example, initial cost),
2. Compatibility (with existing culture and practice),
3. Complexity,
4. Trialability, and
5. Observability.

A product with relative advantage has characteristics such as price, profitability, reliability, aesthetics, and impact on productivity that make it desirable in comparison or as an alternative to other products. Compatibility is the degree to which a product can be integrated with current operations and systems and methods of installation. Complexity is the degree to which an innovation is easy to understand and use.

Trialability is the degree to which a product can be tried or tested by a potential adopter. Observability is the degree to which the product can be observed in operation and the results of the operation determined. Of these, relative advantage and observability are known to be the most important for an adoption decision.

Program Influenced Trigger Events

The interventions around which the AB 549 project is structured tend to focus on key trigger events discussed earlier in this report. However, it is worth noting at this time that energy efficient initiatives tend to influence trigger events by providing information, products or decision choice information into the market, hopefully at key times when the intervention can be expected to be effective. As a result, the process of moving customers through the stages of diffusion are influenced by the initiatives. Consequently, there are two routes into the diffusion of innovation model. These are the standard route that is taken without the initiative, or the non-program-influenced route. However, for the customers influenced by the program, there is the program-influenced route into the adoption process. The purpose of the program-influenced route is that it substantially speeds the adoption rate by moving decision makers into the diffusion process and speeding their movement through the five steps. In a nationally recognized study of the Federal Energy Management Program (FEMP), diffusion of innovation research documented that the FEMP substantially sped up the adoption process, moving decision makers thorough the five steps several times faster than decision makers who moved through the steps who were not program participants. Figure 19 demonstrates the two paths through the adoption model. The non-program assisted path is on the top of the adoption model while the program-influenced path is on the bottom. The goal of the typical energy efficiency program is to move as many people as the program budget allows through the expedited path on the bottom.

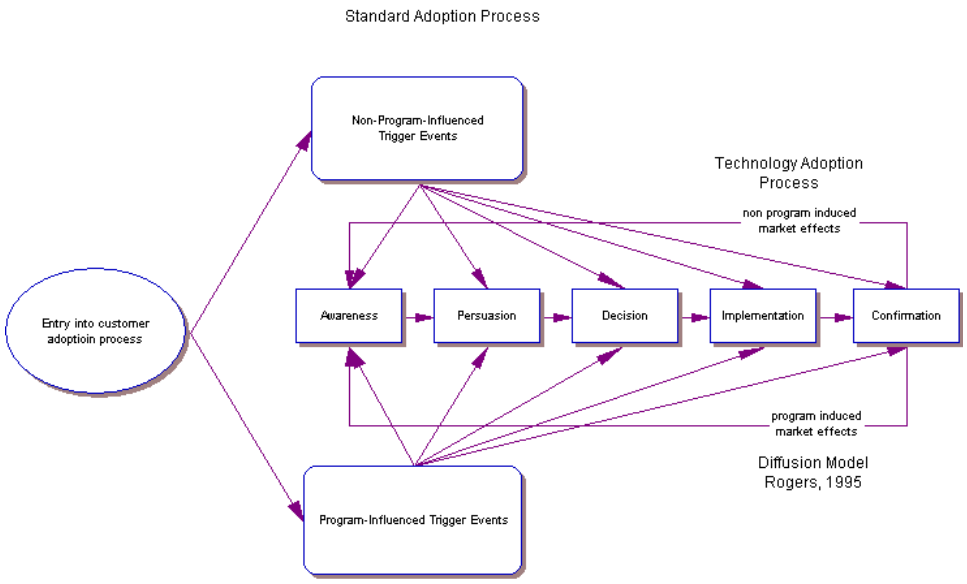


Figure 19. Program Influenced Routes Through the Adoption Process

Trigger Points, Intervention Strategies and the Adoption Model

As discussed in the previous section, there are two paths through the adoption model, the normal path and the program-influenced path. The normal path is influenced by a host of market information, communication and other initiatives that are a normal part of the ever-changing markets in which programs operate. The other entryway to the adoption path is through the program initiative path as a program participant. However, while these paths are displayed differently to clearly demonstrate the different routes into the adoption path, in reality the same market initiatives that influence non-participants also influence participants. Referring again to Figure 3, the top path is the path associated with the normal operations of the market, but it does not include program participation. While customers entering the adoption path may be motivated to enter into the adoption path as a result of program or program-related efforts, they are not direct program participants, and as such, they do not enter the path directly via the energy efficient initiatives placed in the market. The bottom path represents program participants who enter the adoption process directly as a result of program participation.

Figure 3 shows how customers are influenced by a trigger event that causes them to consider a transaction or practice that influences energy consumption within their home or business. The water heater needs repair, the customer wants to upgrade an appliance, the building designer needs to specify an HVAC system, a broken window needs repair, or a business owner wants to reduce utility bills – are all examples of trigger points that cause a transaction to be initiated. If the program is not there to interact with the customer, the customer enters the adoption path without the benefit of a program intervention to help them make the energy efficient choice. If the program is there and the customer becomes a participant, then the initiative is there to help them make the energy efficient choice. The initiative might employ information transfer strategies, incentives to help offset costs, or other approaches. No matter what the intervention, if successful, the program helps the customer enter and move through the adoption path.

By examining Figure 19 and Figure 20 it becomes apparent that the two routes into the adoption path are exactly alike, except that the bottom route moves through the interventions provided by the energy efficiency program initiatives. Figure 21 located below combines Figure 19 and Figure 20 and shows the two different routes into the adoption path.

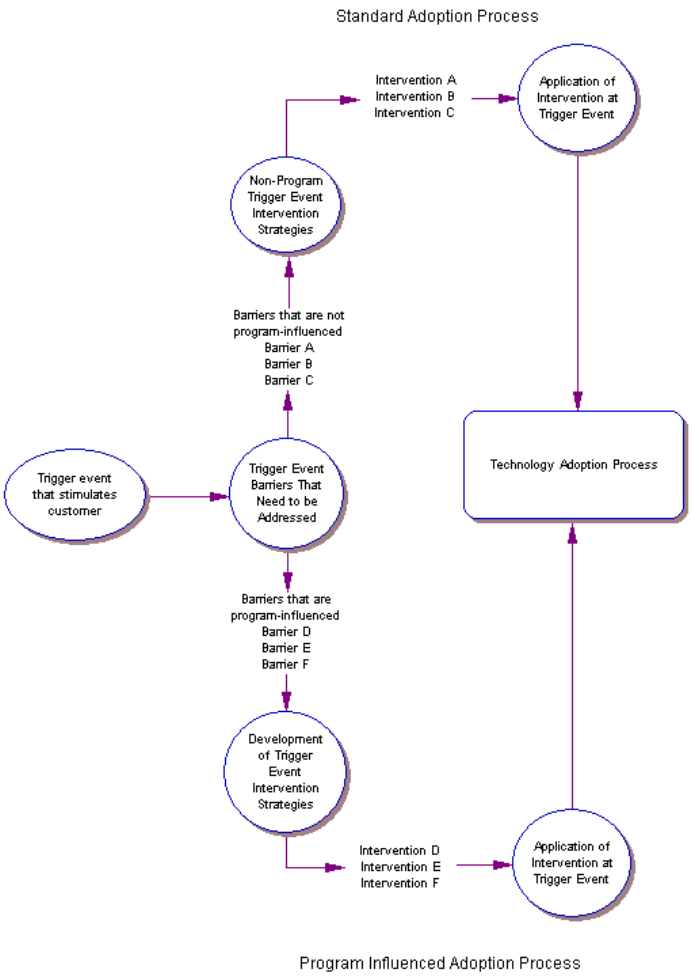


Figure 20. Non-Program and Program-Related Routes into the Adoption Path

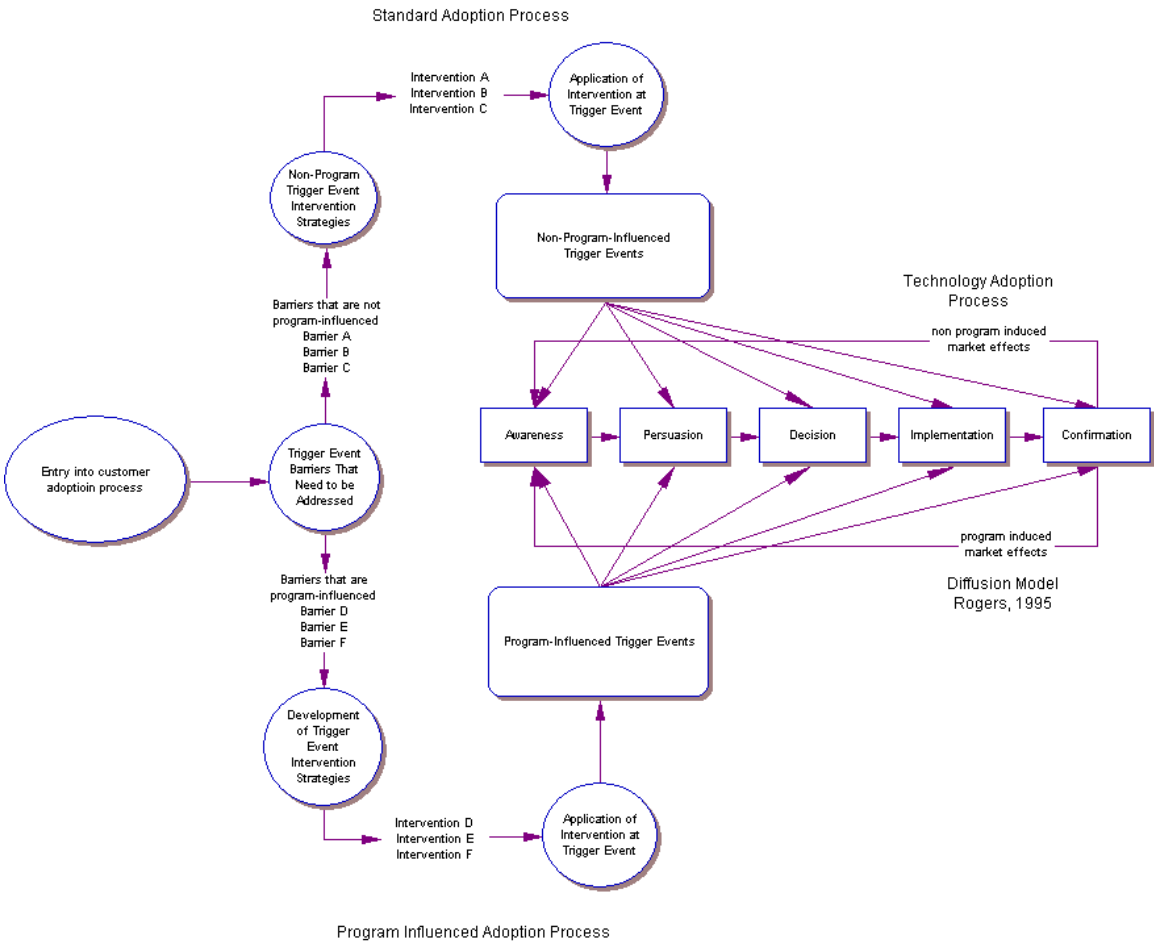


Figure 21. The Normal and Program Related Routes into the Adoption Path

While Figure 21 shows a more complete presentation of entry routes into the adoption path, it is not complete without the market barriers that need to be addressed by the program initiatives. By incorporating the barriers diagram in Chapter 2 of this report it is possible to see how the barriers fit into the adoption path. By placing the barrier classification groups in front of the trigger points and the program initiatives designed to address the barriers, it becomes apparent that the key component of any successful energy efficiency program is how well it addresses the market barriers that limit program participation and allows customers to enter the adoption path without the direct benefits of the program. This is not to suggest that customers will not make the energy efficiency decision without program participation, but it does indicate that via program participation, customers are more likely to make the energy efficiency choice because that route has fewer significant barriers. This is because of the program initiatives designed to reduce those barriers are not directly available to non-participants. Figure 22 puts the different pieces of the puzzle

together and presents the way in which the markets operate with and without program interventions.

On the far left side of this diagram is a box that represents the technical potential associated with energy efficiency decisions in the market. Next are the technology applicability factors that limit the amount of energy efficiency actually available in the market. This is the level of efficiency that is achievable with well-designed energy efficiency initiatives. The next set of boxes provide the market barriers around which programs must be designed to achieve the savings that are available. If programs are designed and implemented so that the barriers associated with making the energy efficient choice are reduced, the achievable potential can be reached. However, this means that programs must be designed to address all market sectors and segments across all customer types. In reality, however, there will never be a condition in which all customers are influenced by programs that eliminate barriers to allow all of the achievable potential to be captured. While this is worthy goal, it is also an impossible goal to reach. The best we can hope for is that good program designs will be developed and deployed in a way that captures as much of the potential as possible.

The degree of success the initiatives have in addressing the barriers through efforts that reach and capture the available potential will, in the end, determine how much of the achievable potential can be captured. The amount of energy resources that can be achieved in the market through energy efficiency initiatives is called the achievable market potential. This potential is dependant on the resources placed in the market to capture this potential and how well the initiatives reduce the market barriers limiting that potential.

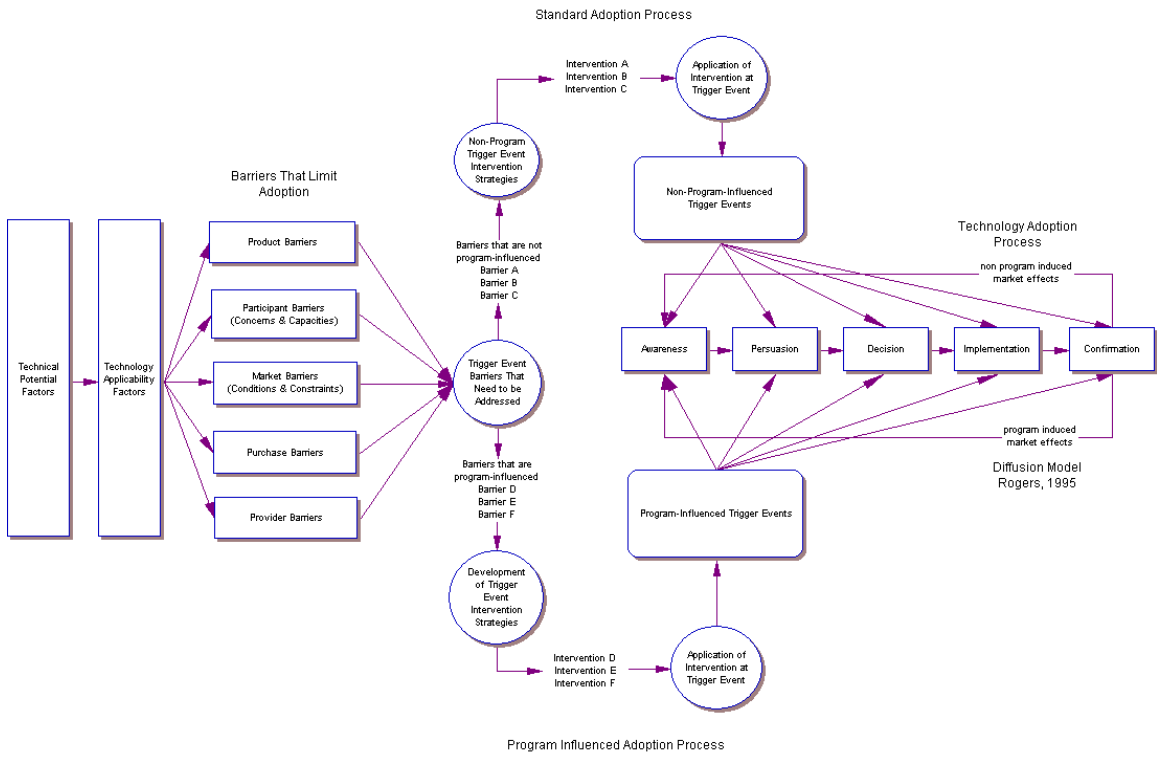


Figure 22. Barriers and the Routes into the Adoption Path

6. COST EFFECTIVENESS AND MARKET/POLICY READINESS

Cost Effectiveness

The cost effectiveness of the intervention strategies was calculated considering the value of the expected energy savings resulting from the intervention and the costs associated with achieving those savings. The energy savings were calculated from the technical energy savings potential for the measures introduced by each intervention and the ability of the intervention to improve the adoption of the measures. Energy cost savings were calculated as the net present value[7] of the energy savings over the life of the measures encouraged by the intervention. Costs to achieve those savings result from the purchase of the new technology, any administrative costs associated with bringing the intervention into the market and any incentives paid to market participants to help reduce market barriers. Cost effectiveness was considered from two perspectives:

Participant Cost Effectiveness. This measure calculates the cost effectiveness of the intervention from the perspective of the customer. The customer cost effectiveness considers energy cost savings resulting from the efficient technology, any incentives paid to the customer to induce the efficient technology purchase, and the out-of-pocket expenses associated with the purchase. It is generally assumed that customers will act in their best economic interest when considering adoption of efficient technology, although behavioral research suggests that the decision is complex and involves many uncertainties and non-energy considerations. The participant cost effectiveness test is included as a measure of the economic rationale for improving building efficiency due to the intervention.

Total Resource Cost Effectiveness. The total resource cost effectiveness evaluates the costs of implementing an intervention as a resource option. The total resource cost test includes participant out of pocket costs, incentive, advertising and administrative costs, and the net present value of the utility avoided costs over the life of the measures addressed by the intervention. The avoided costs used in the calculations were computed using the methodology presented in the 2004 avoided cost study conducted by Energy and Environmental Economics (E Three, 2004). The E Three study considers the time dependent nature of avoided costs and the variation in these costs as a function of location. The avoided costs consider generation costs, transmission and distribution (T&D) costs, and environmental externalities. For example, the avoided costs associated with air conditioning, outdoor lighting, and refrigeration measures are shown in Figure 23 below:

[7] Net present value was calculated at a real discount rate of 3% per annum.

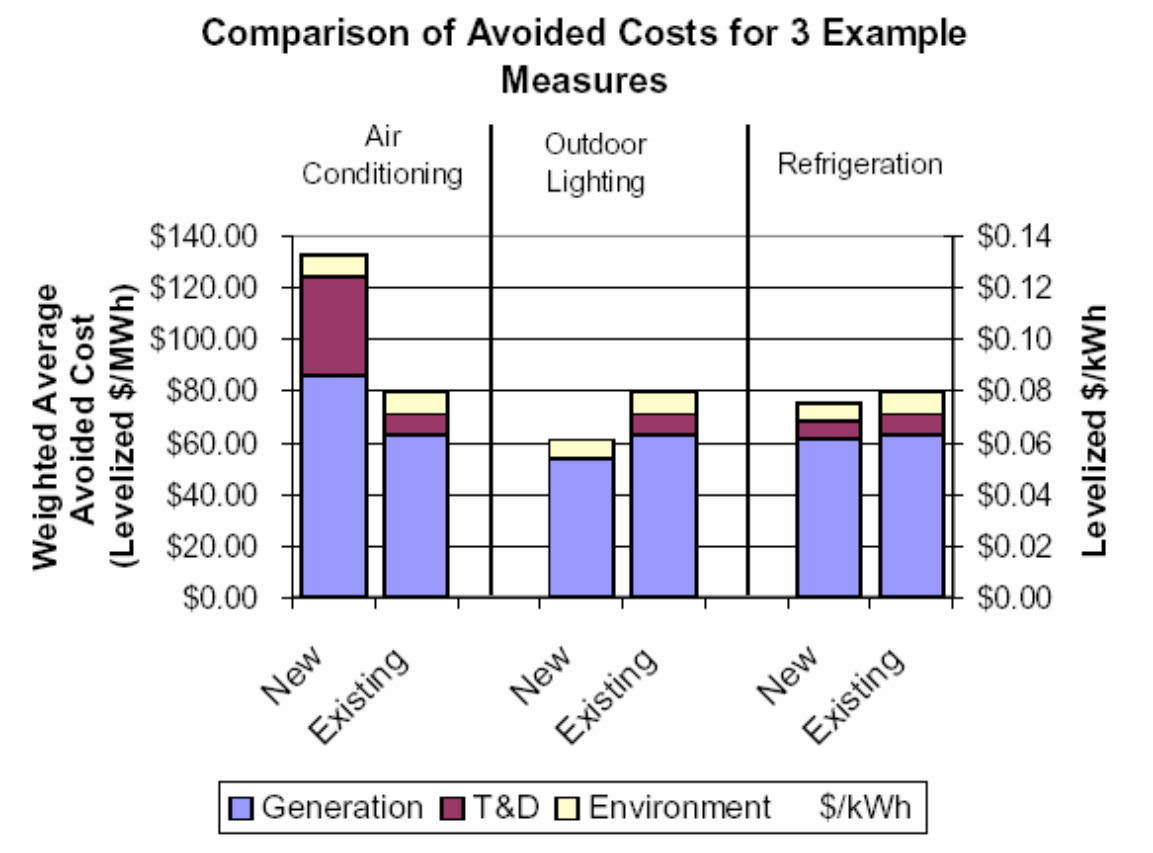


Figure 23. Avoided Costs Example from E Three Study

In this example, air conditioning measures which have higher savings during summer on-peak hours result in a higher avoided cost than do refrigeration measures (with a fairly flat load profile) or outdoor lighting measures (with savings primarily off peak).

Energy savings, product costs and useful life data were taken primarily from the Xenergy New Construction Potential Studies, along with data compiled during the research efforts of the AB 549 project.

Cost Effectiveness of Information Initiatives

Some of the initiatives proposed in this project are designed to stimulate the market through providing information, marketing and education services. These programs serve an important role of reducing information-based barriers intended to increase participation in other hardware-based programs. It is difficult and, in some cases, inappropriate to attempt to assess the energy savings and cost effectiveness associated with these types of programs. The Statewide Evaluation Framework states that “if the program has been created primarily as a conduit that leads participants into other programs or services, or it provides training and education on energy efficiency options to customers and other market actors, then the program

should not be expected to meet the same cost-effectiveness requirements as programs that are offered expressly as a way of acquiring energy resources." (Tecmarket Works, 2004). Thus, an analysis of the cost effectiveness of all the information only interventions will not be attempted.

Intervention Energy Savings Potential and Cost Effectiveness

The energy savings potential and cost effectiveness was calculated for the set of initiatives shown in Table 4. The details of these calculations can be found in Appendix F.

Table 4. Intervention Energy Savings Potential and Cost Effectiveness

Intervention	GWh	MTh	Cost	Part B/C	TRC B/C	Notes
Commercial Retro-commissioning	84.6	16.9	$34,000,000	4.9	2.8	Voluntary with10% adoption at refinance. Rebates offered at 37% of cost
Residential Time-of-sale Energy Rating	76.0	6.3	$8,300,000	3.42	1.34	Voluntary adoption at 10% of homes sold Rebates offered to offset inspection cost
Residential HVAC Tune-up	54.3	0.2		4.78	3.63	Mandatory program; 50% compliance
Low Income Multifamily Housing (Rehabilitation)	38.1	5.3	$58,000,000	3.4	1.6	Full rebates offered
Information to All Homeowners (audits)	36.5		$1,080,000	6.5	0.8	No rebates; on-line audits
Commercial Lease	8.6		$114,000	4.48	1.79	Lighting only
Low Income Multifamily Housing (Tune-up)	0.8	0.1	$1,300,000	3.3	1.5	Full rebates to tune 5% of LI MF units per year

Market/Policy Readiness

The success of an intervention strategy will depend on a certain level of support from policy makers and the market place. Beyond the energy savings potentials, incremental improvements to product adoption from removal of market barriers and the overall cost effectiveness of the intervention, several other subjective criteria

were used to judge the readiness of the intervention. The following criteria were developed by the project team and Energy Commission staff:

Existence of regulatory authority. Interventions considering mandatory regulations will require an authority to issue the regulations and enforce compliance. Interventions that do not fit within the existing regulatory authority of agencies within the California state government may require expansion of an existing regulatory authority.

Degree of policy maker support. The degree to which these interventions are in line with policies adopted by the Energy Commission and the CPUC will influence the readiness of the interventions strategy.

Degree of market participant support. The degree of market participant support for the intervention was assessed. Key market participants were identified, along with their level of influence and perceived level of support. Network diagrams were developed to assess the roles of each market actor and their relative influence.

Ability to pay. Costs to support the interventions will likely be supplied by a combination of state funding, pubic goods charge funding, utility procurement funding and contributions from participating customers. The allocation of the costs across these entities and the ability of these entities to bear the costs was assessed.

Migration path from voluntary to regulatory approach. Several interviews and expert panels have indicated that an abrupt regulatory approach may not be appropriate for some interventions. A phased approach starting with voluntary use of the intervention strategies moving toward regulations may be more appropriate.

Discussion of these criteria with respect to each of the intervention concepts follows.

Information to All Homeowners

Existence of regulatory authority. The CPUC has the authority to regulate utilities and oversee the expenditure of PGC funds. Although the utilities are responsible for developing program portfolios, these must be approved by the CPUC. Activities covered under this intervention can be mandated.

Degree of policy maker support. Audit programs have not gotten much interest in the current round of programs. The next program cycle will likely keep the same focus on hardware rather than information related programs.

Degree of market participant support. Utilities have large investments in billing systems; will require online rather than paper billing approach. Targeting strategies have been used in the past with good results.

Ability to pay. The costs for implementing this intervention would likely be covered by the utilities. There is some question on whether the funds could be better spent on other interventions. Additional state funding may be needed.

Migration path from voluntary to regulatory approach. This intervention exists currently as a voluntary effort. The ability of the CPUC to regulate efficiency programs provides a path toward a regulatory approach to this intervention.

Residential Time of Sale Energy Ratings

Existence of regulatory authority. The Energy Commission has been assigned the responsibility for developing a statewide uniform home energy rating system by the Legislature.

Degree of policy maker support. Support for conclusion of the Home Energy Rating proceeding is good within the Energy Commission.

Degree of market participant support. Several interviewees indicated that the lack of a ruling on home energy rating systems is an impediment to wider use of these systems. Support for concluding the proceeding from the marketplace is good. Home energy ratings conducted at the time-of-sale of a home face significant opposition from the realtor community if they delay the closing of escrow.

Ability to pay. Costs of ratings have been cited as a barrier to homeowners and homebuyers seeking ratings.

Migration path from voluntary to regulatory approach. This intervention exists currently as a voluntary effort. State regulations regarding home energy ratings exist, providing a path toward a regulatory approach.

Residential Whole Building Diagnostic Testing

Existence of regulatory authority. The Energy Commission has jurisdiction over regulating the energy efficiency of building remodeling or renovations requiring a building permit. Whole building diagnostic testing could be made a requirement for obtaining a certificate of occupancy following major renovation work.

Degree of policy maker support. The Energy Commission through the PIER program has supported the California Building Performance Contractors Association (CBPCA) to train contractors in the whole building diagnostic approach. The CPUC has approved the CBPCA for funding during the 2002-2003 and 2004-2005 program cycles as a non-utility program implementer.

Degree of market participant support. Contractor awareness and support for the whole building diagnostic program has been mixed. According to the CBPCA, only about 15 percent of the contractors attending training make whole building diagnostic testing part of their business. Lack of consumer awareness and low demand for the service make it difficult for contractors to make a business out of this approach.

Ability to pay. This intervention provides marketing support for an existing program. Homeowners are expected to carry the cost of the service.

Migration path from voluntary to regulatory approach. This intervention exists currently as a voluntary effort. The ability of the Energy Commission to regulate existing building renovations provides a path toward a regulatory approach to this intervention.

Low Income Multifamily Housing

Existence of regulatory authority. Subsidized housing is a heavily regulated activity within the state. The Energy Commission has jurisdiction over regulating the energy efficiency of building remodeling or renovations requiring a building permit.

Degree of policy maker support. State housing agencies are supportive of efforts to simplify applications for efficiency funding.

Degree of market participant support. Support within the developer and non-profit housing community is not known, but it is assumed that funding to cover the costs and simplified application procedures will reduce opposition.

Ability to pay. New funding will need to be provided for this intervention.

Migration path from voluntary to regulatory approach. This intervention assumes that energy ratings and minimum efficiency standards are mandatory.

Commercial Benchmarking

Existence of regulatory authority. The executive order establishing the Green Building Initiative has mandated benchmarking of all public and private commercial buildings. The Energy Commission is investigating methods to benchmark commercial buildings through a PIER research program.

Degree of policy maker support. Policy makers at the Energy Commission and the Governor's Office support this initiative.

Degree of market participant support. The U.S. EPA Energy Star benchmarking system has some support among commercial building owners in California. Building science researchers have voiced concerns over the ability of benchmarking systems to separate building efficiency, process equipment influences and operational issues within current benchmarking approaches.

Ability to pay. The costs for implementing commercial building benchmarking on a broad scale have been assigned to the utilities. There is some question on whether the funds could be better spent on other more direct interventions.

Migration path from voluntary to regulatory approach. Commercial building benchmarking is currently a voluntary activity. The executive order has mandated the creation of a benchmarking system. Use of the system is voluntary.

Retro-Commissioning

Existence of regulatory authority. The Energy Commission has jurisdiction on major renovations of commercial buildings through the Title 24 Building Energy Efficiency Standards. The 2005 Standards contain a provision for duct leakage testing in existing buildings undergoing a replacement of the HVAC system. The 2005 Standards also contain provisions for Acceptance Testing of Nonresidential Buildings. The acceptance tests are a subset of building commissioning, covering a set of functional performance tests that generally occur during the commissioning process. The acceptance test requirements could be extended to major renovations.

In addition to duct leakage testing, the 2005 Standards contain provisions for refrigerant charge and air flow tests of residential air conditioning systems. These provisions could be incorporated into the commercial building standards in a future update. The CPUC has the authority to regulate utilities and oversee the expenditure of PGC funds. Although the utilities are responsible for developing program portfolios, these must be approved by the CPUC. Activities covered under this intervention can be mandated, but there is no direct mechanism to require building commissioning.

Degree of policy maker support. The Green Building Initiative has placed a high priority on building commissioning.

Degree of market participant support. The commissioning industry has an active national professional organization called the Building Commissioning Association (BCA) along with the California Commissioning Collaborative (CCC). Support for professional development of commissioning service providers and advocacy of commissioning services is good. The marketplace has been slow to adopt commissioning practices in existing buildings.

Ability to pay. Building commissioning can be very cost effective for building owners even without incentives. Incentives may be needed to stimulate the market. The source of these funds can come from the PGC or new funding may be needed.

Migration path from voluntary to regulatory approach. Both the Energy Commission and CPUC have regulatory authority that can influence this intervention.

Energy Efficient Commercial Leasing

Existence of regulatory authority. No state authority currently exists to regulate commercial lease transactions.

Degree of policy maker support. The Green Building Initiative, established by executive order, is planning to address this issue.

Degree of market participant support. Although the split incentive market barrier has been cited as a major barrier to efficiency investments in commercial buildings, very little has been done in the market to promote leasing arrangements to address this barrier. The Building Owners and Managers Association (BOMA) has developed a model lease arrangement with provisions that address the split incentives barrier.

Ability to pay. The intervention has limited need for resources. Buildings with favorable lease arrangements may enter existing programs.

Migration path from voluntary to regulatory approach. No path currently exists to regulate this transaction.

Demand Response

Existence of regulatory authority. The CPUC has the authority to set utility rates. Both the Energy Commission and the CPUC have issued Order Instituting Rulemaking (OIRs) on demand response.

Degree of policy maker support. Policy maker support for demand response at the Energy Commission and the CPUC is strong.

Degree of market actor support. Acceptance of voluntary price response programs in the market has been slow, due to the perceived lack of benefits and risks of higher utility bills.

Ability to pay. Small customers generally do not receive enough benefits to justify the cost of the metering and automated control systems necessary to implement price response programs.

Migration path from voluntary to regulatory approach. The structure to move from voluntary to mandatory demand response rates exists within the CPUC with their ability to set rates.

Upstream Interventions / Manufacturer Partnership Programs

Existence of regulatory authority. The Energy Commission has the authority to set standards relating to appliances through the Title 20 Appliance Efficiency Standards.

Degree of policy maker support. Upstream programs have not received much attention by the CPUC since efficiency policy shifted from market transformation to resource acquisition. The Energy Commission PIER program has an active RD&D partnership program with industry partners.

Degree of market participant support. Manufacturers may have a reluctance to engage with state agencies due to regulatory and intellectual property concerns.

Ability to pay. Incentives for upstream programs would likely come from the PGC fund administered by the CPUC or through the PIER program.

Migration path from voluntary to regulatory approach. The Energy Commission has the authority to regulate certain appliances sold in the state. Appliances covered by Federal Regulations are not generally regulated by the state.

Energy Efficient Procurement and Procurement Support

Existence of regulatory authority. The public purchasing arena in California has regulations in place that govern the consideration of energy efficiency and environmental impacts in state purchasing policies. Local government and non-profit agencies are also permitted to purchase items through state purchasing contracts.

Degree of policy maker support. Existing policies regarding energy efficient purchasing have been as effective as they could be. The Green Building Initiative is addressing this issue.

Degree of market participant support. Purchasing officials are scattered throughout the state in a variety of state organizations and institutions. Use of regulations allowing for purchase of energy efficient products varies widely.

Ability to pay. Bulk purchases of efficient products have been shown to eliminate the cost differential between standard and efficient products.

Migration path from voluntary to regulatory approach. Use of contracting rules favoring the purchase of efficient products is voluntary. Migration to a mandatory process is possible.

Branding

Existence of regulatory authority. The U.S. EPA owns the Energy Star brand, which is the most widely recognized brand for energy efficient appliances and buildings. The Energy Commission is in discussion with the EPA regarding coordinating Energy Star with the California Title 20 Appliance Standards. The Energy Commission has supported the brand Energy Commission-certified for certain efficiency and renewable energy equipment.

Degree of policy maker support. Concern exists with policy makers in California and elsewhere that the Energy Star brand does not set a high enough standard for energy efficiency, and does not provide standards for certain products of interest to the efficiency community.

Degree of market participant support. Energy Star has broad support from manufacturers, retailers, and consumers.

Ability to pay. Establishing a new brand will be very expensive. Engaging Energy Star is likely to be the least costly and most effective approach.

Migration path from voluntary to regulatory approach. Energy Star is by nature a voluntary program with broad support from industry. Coordinating Energy Star efficiency levels with California appliance standards is currently under discussion.

Information, Demonstrations and Case Studies

Existence of regulatory authority. The CPUC has authority to administer the Public Goods Charge funds and approve the efficiency program portfolios developed by the IOUs.

Degree of policy maker support. The statewide Flex Your Power marketing and information program is a non-utility program funded by the CPUC. Utility and local government energy centers have received support from the CPUC. The Energy Commission through the PIER program supports a variety of research, development and demonstration projects.

Degree of market participant support. Manufacturer interest varies from enthusiastic to cautious.

Ability to pay. It is expected that manufacturers will supply significant resources to the demonstration aspects of this effort.

Migration path from voluntary to regulatory approach. This intervention does not favor a regulatory approach.

Energy Efficiency Technical Training

Existence of regulatory authority. The California Department of Real Estate (DRE) licenses real estate agents and regulates the real estate industry. Real estate regulations include requirements for continuing education. The California Community Colleges Chancellor's Office (CCCCO) Board of Governors provides leadership and direction in the continuing development of the California Community Colleges under the state master plan for higher education. Community Colleges are required to participate in a consultation process with the CCCCO Board of Governors.

Degree of policy maker support. The Governor's Office has voiced support for strengthening community colleges and vocational education.

Degree of market participant support. Discussions with the California Association of Realtors regarding including energy efficiency content in continuing education classes were favorable. Since many mortgage brokers also hold real estate licenses, they would also be covered under the continuing education requirements for real estate licensure. Community college course offerings for technical and vocational education in the HVAC field have been on the decline.

Ability to pay. There is no clear source of funding for this initiative.

Migration path from voluntary to regulatory approach. The Department of Real Estate has the authority to regulate course content for the real estate license continuing education requirement.

Certification Programs

Existence of regulatory authority. The Energy Commission has the authority to certify products related to energy efficiency and renewable energy. The Contractors State Licensing Board (CSLB) licenses and regulates contractors in 43 classifications in the construction industry, including thermal insulation, HVAC, glazing, refrigeration, and solar.

Degree of policy maker support. Support for certification of trades and professionals within the Energy Commission appears strong.

Degree of market participant support. Manufacturers have been strong supporters of technician certification. Contractors have been reluctant to become certified.

Ability to pay. Costs to attend training and obtain certification is a barrier to contractor participation.

Migration path from voluntary to regulatory approach. The State of California has the authority to regulate contractors and professionals.

Efficiency Choice Risk Protection

Existence of regulatory authority. Authority for regulating the insurance industry in California rests with the California Department of Insurance (DOI).

Degree of policy maker support. This is a new initiative, with unknown support at the policy level.

Degree of market participant support. Insurance products currently exist to cover the performance of energy efficiency measures installed under energy services contracts.

Ability to pay. Development of this fund outside of the marketplace will require new funding.

Migration path from voluntary to regulatory approach. The Department of Insurance has jurisdiction over the insurance industry, and insurance is mandatory for certain activities.

Interagency / Cross Program Coordination

Existence of regulatory authority. The CPUC has the authority to regulate utilities and oversee the expenditure of PGC funds. Although the utilities are responsible for developing program portfolios, these must be approved by the CPUC. Inter-program coordination is an aspect of program design that the CPUC can direct.

Degree of policy maker support. The CPUC has taken steps to improve program coordination. The Flex Your Power website contains a central directory of programs available based on service territory, building type and equipment. High level discussions between the CPUC and the Energy Commission have occurred to coordinate policy.

Degree of market participant support. Competition between programs makes coordination difficult. The lack of policy on how to allocate energy savings between programs exacerbates the problem.

Ability to pay. Program coordination activities are a program cost that should be budgeted. These costs should not be excessive.

Migration path from voluntary to regulatory approach. Program design criteria listed in the CPUC Energy Efficiency Policy Manual that emphasize coordination will encourage program designs that include this element. Although program coordination is voluntary, proposal scoring criteria that give weight to this element will encourage this design.

Cross-Intervention Comparison

A qualitative comparison of the policy and market readiness criteria across each of the intervention strategies is provided in Table 5 below.

Table 5. Market and Policy Readiness Criteria Comparison

	Existence of regulatory authority	Policy Maker Support	Market Actor Support	Ability to pay	Path from Voluntary to Regulatory
Information to All Homeowners	●	μ	⭘	μ	λ
Residential Time-of-Sale Energy Ratings	●	λ	⭘	μ	λ
Residential Whole Building Diagnostic Testing	⭘	λ	⭘	λ	⭘
Low Income Multifamily Housing	λ	λ	μ	μ	λ
Commercial Benchmarking	λ	λ	⭘	⭘	⭘
Retro-Commissioning	⭘	λ	λ	⭘	⭘
Energy Efficient Commercial Leasing	μ	λ	⭘	λ	μ
Demand Response	λ	λ	μ	μ	λ
Upstream Interventions / Manufacturer Partnerships	λ	⭘	⭘	λ	λ
Energy Efficient Procurement and Procurement Support	λ	λ	⭘	λ	λ
Branding	⭘	λ	λ	μ	μ
Information, Demonstrations and Case Studies	λ	λ	⭘	⭘	μ
Energy Efficiency Technical Training	⭘	λ	⭘	μ	⭘
Certification Programs	λ	λ	⭘	μ	λ
Energy Efficiency Choice Risk Protection	λ	μ	λ	μ	λ
Interagency Coordination	λ	λ	μ	⭘	⭘

Note: λ indicates a high ranking; ⭘ indicates a medium ranking, and μ indicates a low ranking. For example, a high ranking under ability to pay means that funding sources are readily available.

7. POLICY AND LEGAL CHANGES

Successful introduction of this set of interventions will require several policy and legal changes at all levels of government. Policy and legal changes suggested by this research include:

Changes to Existing State Statutes

Home Inspection statute change. Section 7195 of the Business and Professions Code governs home inspections. Subparagraph 2 governs energy inspections, and defines what constitutes and energy inspection. Energy inspections are an optional component of a home inspection. Changing this statute to making energy inspections a mandatory component of home inspections is recommended.

New Legislation

Community College and VoTech support***.*** State funding earmarked for community college, vocational school, or trade union training programs in HVAC is recommended to help supply a trained work force for the industry.

Procurement. Legislation with funding to establish coordinated procurement systems and product assessment function is recommended.

Energy Improvement Mortgages. Legislation requiring the secondary mortgage market to maintain a certain number of energy improvement mortgages in their portfolio is recommended.

Executive Orders

Procurement. An executive order requiring offices under the Governor to coordinate procurement approach is desired.

Commissioning. The Green Building initiative should consider requiring certification of retro-commissioning agents used on state buildings.

Energy Commission Policy

HERS proceeding. The Energy Commission is encouraged to conclude the proceeding on Home Energy Rating Systems.

Title 24 reach into existing building renovations. The Energy Commission should consider extending the reach of Title 24 into remodeling or renovation activities in existing buildings.

Policy on branding approach. The Energy Commission should continue to influence the U.S. EPA on changes to Energy Star that benefit California, while formulating a policy on how the brand should be applied.

Financing program development. The Energy Commission should consider development of financing programs for energy efficiency improvements.

HVAC equipment tune-ups. Mandated diagnostic based equipment tune-ups and installation at time-of-sale and time of replacement is recommended.

CPUC Policy

Non-energy benefits. Residential and commercial consumers make energy efficiency-relevant decisions in order to optimize both energy and non-energy benefits. Consider allowing the inclusion of non-energy benefits in program cost effectiveness calculations under certain circumstances. Alternatively, allow the use of methodologies for estimating costs that more accurately weight the energy components of real-world investment decisions.

Program emphasis. Consider funding programs that support the initiatives recommended by this study, including residential whole building diagnostics, commercial retro-commissioning efforts, upstream manufacturer incentive programs, energy improvement mortgages, including incentives for raters, inspectors, and lenders.

Coordination between programs that provide referrals. Develop a policy on how to account for energy savings between programs that provide and receive referrals.

Value self-verification in M&V. Investigate systems that can provide valid verification of installation quality and measure effectiveness and establish a role for these systems within EM&V policy.

Coordinate efficiency and demand response initiatives. Allow the use of PGC funds for both energy efficiency and demand response programs, and encourage program designs that provide an integrated delivery approach.

Flex Your Power. Use Flex Your Power as a means to promote a variety of initiatives within this study as they are developed, including quality air conditioning installation and certified home improvement contractors.

Policies of State Housing Agencies

Grant requirements. Require energy ratings and apply minimum efficiency standards to affordable housing projects receiving state funding.

U.S. Department of Housing and Urban Development

Utility Allowances. Work with HUD to write separate utility allowance guidelines for energy efficiency projects.

U.S. Green Building Council

Leasing arrangements**.** Discuss with USGBC credit for building leasing arrangements that encourage efficiency investments shared by building owners and tenants.

Professional Organizations

Continuing Education. Institute an energy component into continuing education classes for realtors and appraisers.

8. REFERENCES

Bijker, Weibe. 1997. Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change. Cambridge, MA: MIT Press.

Bijker, Weibe and John Law, eds. 1994. Shaping Technology / Building Society: Studies in Sociotechnical Change. Cambridge, MA: MIT Press.

Bijker, Weibe, Thomas P. Hughes and Trevor Pinch. 1989. The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology. Cambridge, MA: MIT Press.

Blumstein, Carl, Loren Lutzenhiser and Seymour Goldstone. 2001. "From Technology Transfer to 'Market Transformation.'" Proceedings, European Council for an Energy Efficient Economy. Paris: ECEEE Press.

Coito and Rufo, 2003b. California Statewide Commercial Sector Natural Gas Energy Efficiency Potential Study, Prepared for Pacific Gas and Electric Company, available at www.calmac.org.

Coito, F. and M. Rufo, 2003a. " California Statewide Residential Sector Energy Efficiency Potential Study (volumes 1&2)", Prepared for Pacific Gas and Electric Company by Xenergy, Inc., available at www.calmac.org.

Dosi, Giovanni. 1982. "Technological Paradigms and Technological Trajectories." Research Policy. 11:147-162.

Eto, Joseph, Jeff Schlegle and Ralph Prahl. 1996. A Scoping Study on Energy Efficiency Market Transformation by California Utility DSM Programs. Berkeley: Lawrence Berkeley National Laboratory.

Hughes, Thomas P. 1993. Networks of Power: Electrification in Western Society, 1880-1930. Baltimore: Johns Hopkins University Press.

Hughes, Thomas P. 1989. "The Evolution of Large Technological Systems." in W. Bijker, T.P. Hughes and T. Pinch, eds. The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology. Cambridge, MA: MIT Press.

Kunkle, Richard, Loren Lutzenhiser and Linda Dethman. 2000. “Influencing the Purchase of Energy Efficient Products: It's Not as Easy as It Looks.” Proceedings, American Council for an Energy Efficient Economy. Washington, DC: ACEEE Press 8:185–196.

Lutzenhiser, Loren. 1992. “A Cultural Model of Household Energy Consumption” Energy–The International Journal. 17:47-60.

Lutzenhiser, Loren. 1993. “Social and Behavioral Aspects of Energy Use.” Annual Review of Energy and the Environment. 18:247-89.

Lutzenhiser Associates. 2004. Social Science Literature Review: AB549 Intervention-Relevant Work. Portland, OR.

Lutzenhiser Associates. 2005. Social Segmentation and the Identification of Market Potential: A Secondary Analysis of the 2004 California Residential Appliance Saturation Survey (RASS). Portland, OR.

Lutzenhiser, Loren, Craig Harris and Marvin Olsen. 2001. “Energy, Society and Environment” pp. 222-271 in Riley Dunlap and William Michaelson, eds. Handbook of Environmental Sociology. Westport, CT: Greenwood Press.

Pacey, Arnold. 1991. Technology and World Civilization: A Thousand-Year History. Cambridge, MA: MIT Press.

Rogers, Everett. 2003. The Diffusion of Innovations (5th edition). New York: Free Press.

Rufo, M. and Coito, F., 2002. California Statewide Commercial Sector Energy Efficiency Potential Study. Xenergy for PG&E, Study ID #SW 039A, July 9, 2002.

Shove, Elizabeth. 1997. “Revealing the Invisible: Sociology, Energy and the Environment.” In M.R. Redclift and G.R. Woodgate, eds. The International Handbook of Environmental Sociology. Cheltenham, UK: Edward Elgar.

Shove, Elizabeth, Loren Lutzenhiser, Simon Guy, Bruce Hackett, and Harold Wilhite. 1998. “Energy and Social Systems.” pp. 201-234 in Steve Rayner and Elizabeth Malon, eds. Human Choice and Climate Change. Columbus, OH: Battelle Press.

White, Leslie. 1976. The Concept of Cultural Systems: A Key to Understanding Tribes and Nations. New York: Columbia University Press.

Wilhite, Harold and Loren Lutzenhiser. 1999. “Social Loading and Sustainable Consumption.” Advances in Consumer Research. 26:281-287.

Wilhite, Harold, Elizabeth Shove, Loren Lutzenhiser and Willett Kempton. 2001. “The Legacy of Twenty Years of Energy Demand Management: We Know More About Individual Behavior But Next to Nothing About Demand.” pp. 109-126 in Ebarhard Jochem, Jayant Sathaye and Daniel Bouille, eds. Society, Behaviour and Climate Change Mitigation. Dordrecht, Netherlands: Kluwer Academic Publishers.

Wilk, Richard. 1996. Economies and Cultures: Foundations of Economic Anthropology. Boulder, CO: Westview Press.