QUANTUM CONSULTING

NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

VOLUME R8 – RESIDENTIAL NEW CONSTRUCTION BEST PRACTICES REPORT

Submitted to

California Best Practices Project Advisory Committee
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ES. EXECUTIVE SUMMARY FOR RESIDENTIAL NEW CONSTRUCTION PROGRAM AREA (R8)

ES.1 INTRODUCTION

This volume presents results of a comparative analysis of residential new construction programs included in the National Energy Efficiency Best Practices Study ("Best Practices Study"). The overall Best Practices Study objectives, scope, and methodology are briefly outlined in Appendix R8A of this report. More details on methods and cross-program findings are provided in separate report volumes.

The Best Practices Study team ("Best Practices Team") reviewed seven residential new construction programs for this program area study ("R8 Programs" and "R8 Study," respectively), each of which has the goal of capturing energy efficiency gains through increased attention to integrated design and overall construction quality. All R8 Programs focused on whole-building performance, though several programs also included technology-specific requirements or incentives.

The R8 Programs are listed in Exhibit R8-E1 below and presented in the body of this report. A discussion of the program selection process is provided in Appendix R8A.

ES.2 KEY CATEGORY THEMES

The R8 Programs all focused on whole-building performance. This focus reflects the fact that new construction presents a unique opportunity to capture energy efficiency gains through increased attention to integrated design and overall construction quality. Once a home is built, further cost-effective energy efficiency opportunities are limited to select technology upgrades, either as retrofits or as part of routine replacement.

Energy efficiency in new construction is a particular challenge to program designers because of the pervasive split incentive barrier (i.e., the party responsible for energy efficiency decisions is not the one who will ultimately reap related benefits). Most homes are built "on-spec" and sold to the eventual resident at or near completion. The home builder has no long-term interest in energy efficiency because he does not pay the energy bills. The occupant has an interest in energy efficiency but lacks a substantive role in the construction process. In principle, the split incentive could be bridged if the home builder were able to recoup the energy efficiency investment in the form of a higher sales price. But the home buyer generally lacks the technical skills to evaluate energy efficiency claims – and value - and must consider them in the context of a number of bundled home attributes that are usually more important to her.

In this context, the R8 Programs all adopted a strong market transformation emphasis, even when quantifying and offering incentives for direct energy impacts for resource acquisition purposes. The market transformation focus led to several program themes that transect program components: private sector support, combined supply-side/demand-side strategy, and program brand equity.

Private Sector Support - Active support from private sector stakeholders and trade allies was essential. Program managers emphasized the role of builders, contractors, and trade associations in designing programs, crafting marketing messages, and selling energy efficiency to home buyers.

Combined Supply-side / Demand-side Strategy - Program staff members worked closely with builders and contractors to improve the quality and availability of energy-efficient homes. They also offered extensive consumer education resources to stimulate market demand and help bridge the split incentive gap. A key component of the demand-side strategy was a high-profile market brand (usually ENERGY STAR®) that allowed home buyers to identify energy-efficient homes without first developing the technical expertise to evaluate builder claims.

Program Brand Equity - Perhaps the most valuable program asset was the credibility of the program's market brand as an indicator of trustworthy and accurate information. The need to develop and protect brand equity drove project documentation requirements, the site inspection process, quality-control measures at all phases of program implementation, and impact evaluation objectives.

ES.3 BEST PRACTICES SUMMARY

Best practices are identified in the R8 Study for each of the four major program components used to organize data collection and analysis. These program components are Program Design (including program theory), Program Management (including project management, reporting and tracking, and quality control and verification), Program Implementation (including participation process and marketing and outreach) and Program Evaluation. Best practices were developed by analyzing information across programs developed from detailed interviews of program managers and thorough review of all relevant secondary sources such as program filings and evaluations. Exhibit R8-E2 presents the list of best practices developed from the analysis of R8 Programs. For this program area, some specific lessons learned around the program participation process were also identified. These lessons are provided in Exhibit R8-E3. Exhibit R8-E4 provides the rationales associated with each best practice. The remainder of this report provides detailed analysis and discussion of program features and best practice rationales.

The scope of this study also includes a California gap analysis. A comparison of the best practices presented in this report with the practices employed in California's Statewide Residential New Construction Program is in progress and will be published when complete in a separate document.

Exhibit R8-E1
R8 Programs: Residential New Construction Programs Reviewed For R8 Study

Program Name	Implementer/s	Abbreviation for R8 Report
2001-2002 Austin Green Building Program	Austin Energy	Austin Green Building
2002 California ENERGY STAR New Homes Program	Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), Southern California Gas Company (SCG), and San Diego Gas & Electric Company (SDG&E)	CA ENERGY STAR New Homes
2002 New Jersey ENERGY STAR Homes	Clean Energy for New Jersey	NJ ENERGY STAR Homes
2002 Texas ENERGY STAR Homes Program	Oncor	TX ENERGY STAR Homes
2002 Tucson Guarantee Home Program	Tucson Electric Power	Tucson Guarantee Home
2001 Vermont ENERGY STAR Homes	Efficiency Vermont	VT ENERGY STAR Homes
2001-2002 Wisconsin ENERGY STAR Program	Wisconsin Energy Conservation Corporation (WECC)	WI ENERGY STAR

Exhibit R8-E2
Summary List of Best Practices for Residential New Construction Programs

Program Theory and Design
• Have a well-articulated theory or program logic • Link program tactics to the stated theory • Plan thoroughly • Involve multiple stakeholders • Build feedback loops into the program design • Maintain program design flexibility • Understand local market conditions • Use targeted incentives • Focus first on developing supply-side capacity • Do not over-promise results
Program Management: Project Management
• Include stakeholders in developing a program process or operational plan • Put the process plan in writing • Keep management teams small • Maintain good staff morale • Make sure at least some of the institutional memory resides in-house, not with subcontractors • Avoid giving a single contractor exclusive responsibility for program implementation • Provide staff with good training that matches skill needs • Reward high performing staff and link performance evaluations to tangible measures which are known in advance and developed together jointly by the manager and employee • Match staff decision-making authority to responsibilities and delegate responsibility and authority to avoid institutionalized bottlenecks • Get upper management buy-in
Program Management: Reporting and Tracking
• Define and identify the key information needed to track and report early in the program development process • Minimize duplicative data entry; link databases to exchange information dynamically • Track market transformation program qualitative benefits and measures related to spillover effects, along with direct savings impacts • Develop accurate algorithms and assumptions on which to base estimates of savings • Design databases to be scalable to accommodate changes in program scope • Use the Internet to facilitate data entry and reporting • Automate routine functions such as monthly reports • Build in rigorous quality control screens for data entry • Document the tracking system carefully

Program Management: Quality Control and Verification
• Treat inspection visits as partnership-building & learning events rather than just regulatory enforcement activities • Require builder or builder's representative to be on-site during inspection • Plan to rely on third-party inspectors for quality control over the long-term • Encourage home inspectors to organize their own professional organization • Provide timely feedback to builders, home inspectors, and other parties • Ensure that inspectors have plenty of hands-on construction experience • Establish a streamlined inspection scheduling process • Recognize the different inspection needs of experienced builders and builders who are new to the program • Host pre-construction meetings with the builder, key subcontractors, and suppliers to review project specifications and program requirements
Program Implementation: Participation Process
• Establish a robust program brand to differentiate energy-efficient homes from conventional homes • Offer assistance in preparing and submitting program applications • Minimize documentation requirements that would entail preparing new documents not already developed in the course of project permitting • Use targeted incentives • Link incentives to building performance requirements • Establish minimum requirements for builders • Build strategic alliances with equipment manufacturers and encourage them to add their own incentives • Target measure incentives to home buyers to encourage them to ask for the higher efficiency equipment • Solicit home inspector input when developing ethics guideline and customer service standards • Encourage home inspectors to take over training functions • Develop a technical and procedural manual for builders • Avoid vague or inconsistent technical standards that do not take into account broader building performance implications • Offer a bill guarantee • Extend program construction standards beyond energy features
Program Implementation: Marketing and Outreach
• Market to multiple departments within volume builder organizations • Take information to builders – use a "push" rather than "pull" marketing approach • Know your target consumer demographic, tailor your message to the audience and develop effective cross-marketing strategies • Combine point-of-sale marketing via builder sales agents with direct marketing to home buyers • Give builders an opportunity to participate in developing marketing messages
Program Evaluation
• Support program review and assessment at the most comprehensive level possible • Ensure that evaluation metrics are in-line with program goals • Clearly explain evaluation roles and responsibilities to participants in advance • Select an evaluator who has a detailed understanding of the market context in which a program operates • Allow for plenty of interaction between evaluators and implementation staff • Ensure the clarity of the evaluation document • Periodically review and update market-level information about construction practices and energy efficiency measure adoption • Periodically review and update algorithms for calculating project savings

Exhibit R8-E3
Residential New Construction Programs Lessons Learned – Participation Tactics

Participation Tactic	Lessons Learned
Financial Incentives	• Useful for overcoming builder resistance but not absolutely required • Most useful for off-setting financial impacts of inspection requirements • More mature programs can reduce incentive levels, based on demonstrated market value of homes built and certified to program standards
Program Membership	• Builder participation is key • Participation from architects and contractors also useful
Membership Requirements	• Require builder to sign ENERGY STAR Partnership Agreement or other pledge to build to program standards • On-going training requirements for builders, architects, and contractors add value
Design Review	• Offer design assistance to help builders trouble-shoot problematic designs and improve overall home performance at a stage where changes are still cost-effective • Assist with building energy simulations, life cycle cost analysis, Manual J calculations
On-site Inspections	• Inspect mechanical rough-in and final for sampled projects • Design sampling protocol to ease inspection burden on experienced builders with demonstrated track record of performance • Include performance tests, i.e., duct test, pressure test, blower door test
Cooperative Advertising	• Promote program builders by name • Solicit builder input on marketing messages and strategy • Train builder's sales staff
Certification Requirements	• Home certification and labeling is essential for overcoming split incentives and asymmetric information barriers • Certification requires clear-cut inspection process to protect program credibility and brand equity
Technical Assistance	• Offer regular training opportunities • Encourage rates to offer technical assistance as part of inspections, i.e., emphasize role as builder's ally rather than rule enforcer • Engage raters in providing training courses for builders, contractors, architects
Bill Guarantee	• Utility's performance guarantee is effective at overcoming home buyer's uncertainty about expected performance • Bill guarantee provides builder with additional marketing tool, thus creating additional incentive to undergo inspections, document HVAC sizing calculations, and other program requirements • Properly structured bill guarantee creates minimal financial risk for utility

Exhibit R8-E4
Summary of Best Practices Rationales for Residential New Construction Programs

Best Practice	Rationale
Program Theory and Design	
Have a well-articulated theory or program logic	Helps identify any gaps in program focus or effort and assures that everyone involved understands program objectives.
Link program tactics to the stated theory	Assures that programs are fundable, feasible, and capable of being evaluated.
Plan thoroughly	A detailed, well thought-out plan is easier to present and explain to potential critics.
Involve multiple stakeholders	Include potential program beneficiaries, trade allies, and regulators / policy makers to get their buy-in and support.
Build feedback loops into the program design	Assures that stakeholders continue to provide input throughout program implementation.
Maintain program design flexibility	Program must be able to respond to changing market conditions and address unforeseen challenges throughout program implementation.
Understand local market conditions	Important for recognizing which lessons from other areas transfer to the local market and which ones do not; objective baseline market research bolsters design credibility.
Use targeted incentives	Help establish the program's credibility in the minds of private-sector market actors who may be reluctant to be the first to try something new.
Focus first on developing supply-side capacity	Program credibility will be undermined if program promises something to consumers it cannot deliver.
Do not over-promise results	Overly optimistic promises may attract more interest early on but they set the stage for disappointment later.

Best Practice	Rationale
Program Management: Project Management	
Include stakeholders in developing a program process or operational plan	Bolster the plan's credibility, produce a plan that reflects local market conditions, and address needs of stakeholders with divergent viewpoints.
Put the process plan in writing	A written plan is more likely to be a well thought-out plan and is easier to disseminate to the various affected stakeholders.
Keep management teams small	Small teams allow for maintaining close coordination, facilitating good communication, and increasing the likelihood of reaching consensus.
Maintain good staff morale	Ensure staffing stability and develop long-term institutional memory.
Make sure at least some of the institutional memory resides in-house, not with subcontractors	Avoid exclusive reliance on subcontractors for advice on key policy issues.
Avoid giving a single contractor exclusive responsibility for program implementation	Stimulate competition, provide a basis for accountability, and build in redundancy in the event any one contractor fails to perform.
Provide staff with good training that matches skill needs	Program services will only be as good as the people who deliver them. Human resources are as important to program success as financial resources.
Reward high performing staff and link performance evaluations to tangible measures which are known in advance and developed together jointly by the manager and employee	Staff will perform better when they clearly understand what is expected of them and they agree that the expectations are reasonable.
Match staff decision-making authority to responsibilities and delegate responsibility and authority to avoid institutionalized bottlenecks	Prerequisite for performance expectations that are perceived as reasonable.
Get upper management buy-in	Residential new construction programs require several years to generate tangible impacts. Upper management must embark on the process with patience, reasonable expectations, and a commitment to fund the entire start-up phase

Best Practice	Rationale
Program Management: Reporting and Tracking	
Define and identify the key information needed to track and report early in the program development process	Clearly articulated data requirements enhance the prospects that those requirements will be met.
Minimize duplicative data entry; link databases to exchange information dynamically	Minimize redundant data entry efforts, reduce inconsistencies.
Track market transformation program qualitative benefits and measures related to spillover effects, along with direct savings impacts	If program rationale is to generate market effects, those effects must be tracked to determine program success.
Develop accurate algorithms and assumptions on which to base estimates of savings	Help set reasonable expectations and avoid the temptation to oversell program benefits.
Design databases to be scalable to accommodate changes in program scope	Enhance the program's overall flexibility and ability to respond to unforeseen market conditions.
Use the Internet to facilitate data entry and reporting	Enhance the quality and cost-effectiveness of information management; help minimize duplicative data entry and storage and automate many routine quality-control steps.
Automate routine functions such as monthly reports	Build in quality control checks and free up staff time for more strategically important tasks.
Build in rigorous quality control screens for data entry	Minimize the extent of subsequent data cleaning and enhance the accuracy and credibility of reported results.
Document the tracking system carefully	Help mitigate problems stemming from staff turnover, especially when the system must serve a variety of users with varying computer skill levels.
Program Management: Quality Control and Verification	
Treat inspection visits as partnership-building and learning events rather than just regulatory enforcement activities	Rater should be builders' ally for quality control.

Best Practice	Rationale
Require builder or builder's representative to be on-site during inspection	Demonstrate the value of the inspection and reinforce the notion of the inspection as a training/education opportunity rather than program enforcement.
Plan to rely on third-party inspectors for quality control over the long-term	Builder self-certification provides too many opportunities for abuses that undermine brand equity and consumer confidence in program claims.
Encourage home inspectors to organize their own professional organization	Harness market forces to provide monitoring and quality control.
Conduct follow-up inspections of selected project	Provide quality control of rater's results and assess the program's influence on the project.
Provide timely feedback to builders, home inspectors, and other parties	Respect builder and contractor time constraints; capture one-time opportunities for positive program impacts.
Ensure that inspectors have plenty of hands-on construction experience	Essential if raters are to fill role of teachers and mentors
Establish a streamlined inspection scheduling process	Avoid imposing hidden costs on program participants in the form of project delays.
Recognize the different inspection needs of experienced builders and builders who are new to the program.	Newer builders need more attention to master the details of quality construction.
Host pre-construction meetings with the builder, key subcontractors, and suppliers to review project specifications and program requirements	Establish clear communication with the builder and demonstrate the importance of good planning.
Program Implementation: Participation Process	
Establish a robust program brand to differentiate energy-efficient homes from conventional homes.	Brands help capture the market value of energy efficiency and permit home buyers to identify more energy-efficient homes without mastering the technical details of home construction practices.
Offer assistance in preparing and submitting program applications	The level of documentation required to demonstrate whole-building performance can be significant. Minimize barriers to participation.

Best Practice	Rationale
Minimize documentation requirements that would entail preparing new documents not already developed in the course of project permitting	Help minimize the administrative burden associated with program participation.
Use targeted incentives	Help establish the program's credibility in the minds of private-sector market actors who may be reluctant to be the first to try something new.
Link incentives to building performance requirements	Performance-based incentives provide more project design flexibility than prescriptive incentives.
Establish minimum requirements for builders	Protect and enhance program's market reputation as a trustworthy arbiter of quality and energy efficiency.
Build strategic alliances with equipment manufacturers and encourage them to add their own incentives	Leverage existing market forces to enhance and extend program effectiveness.
Target measure incentives to home buyers to encourage them to ask for the higher efficiency equipment	Particularly useful for technology choices that are frequently left to the buyer, such as light fixtures and appliances.
Solicit home inspector input when developing ethics guideline and customer service standards	Produce guidelines that will be respected and followed rather than ignored.
Encourage home inspectors to take over training functions	Create opportunities for professional advancement as a rater, capitalize on raters' field experience.
Develop a technical and procedural manual for builders	Make participation straightforward, routine, and predictable; reduce the degree of "hand-holding" program staff must provide.
Avoid vague or inconsistent technical standards that do not take into account broader building performance implications	Make participation straightforward, routine, and predictable; reduce the degree of "hand-holding" program staff must provide.
Offer a bill guarantee	Could be a low-cost strategy for enhancing credibility of program benefit claims.

Best Practice	Rationale
Extend program construction standards beyond energy features	Coupling energy efficiency with other desirable building attributes can enhance program appeal. Limit claims to those that can be supported by building science and cost-effective increases in consumer demand.

Program Implementation Marketing & Outreach	
Market to multiple departments within volume builder organizations	Each department has an important role in the project. Lack of buy-in from any one department can undermine the effectiveness of other department efforts.
Take information to builders – use a "push" rather than "pull" marketing approach	Cannot wait for builders to come to you because they won't.
Know your target consumer demographic, tailor your message to the audience and develop effective cross-marketing strategies	Customer demographics vary widely by region and one-size does not fit all as a marketing strategy.
Combine point-of-sale marketing via builder sales agents with direct marketing to home buyers	Builders need to be convinced that improved energy efficiency can translate into added value at the point of sale.
Give builders an opportunity to participate in developing marketing messages	Take advantage of builders' accumulated marketing experience.
Program Evaluation	
Support program review and assessment at the most comprehensive level possible	Gain the most detailed understanding of program cause and effect that available resources and reporting requirements will support.
Ensure that evaluation metrics are in-line with program goals	The only way to assess program progress toward achieving predetermined goals is to establish metrics that measure that progress.

Best Practice	Rationale
Clearly explain evaluation roles and responsibilities to participants in advance	Avoid later confusion from having multiple parties contacting the participant for similar information.
Select an evaluator who has a detailed understanding of the market context in which a program operates	Enhance the value of evaluation findings for improving program delivery.
Allow for plenty of interaction between evaluators and implementation staff	Direct interaction gives the evaluator a clear understanding of program dynamics. Clear communication channels are essential.
Ensure the clarity of the evaluation document	Clearly describing program goals, strategies and lessons learned ensures that program staff, stakeholders and other interested parties may gain a good understanding of the program.
Periodically review and update market-level information about construction practices and energy efficiency measure adoption	Program design must reflect current market conditions. Program resources should not be expended to promote technologies and practices that are already widely adopted or standard industry practices.
Periodically review and update algorithms for calculating project savings	Savings algorithms should be reasonably calibrated with real-world building performance, which changes over time as construction practices and available technologies change.

1. OVERVIEW OF REVIEWED PROGRAMS

Although based in areas across the United States, all the R8 Programs focused on increasing the energy efficiency of residential new construction projects and were consistent in their emphasis on whole-house building science and quality construction. Several programs also included technology-specific requirements or incentives. All R8 Programs also relied on one or more site inspections during the construction process to verify building construction quality and provide feedback to the builder on opportunities for improvement. Five of the seven R8 Programs incorporated the EPA's ENERGY STAR® brand into their marketing and outreach strategy and a sixth program incorporated ENERGY STAR standards into its performance criteria.

ENERGY STAR-qualified homes are third-party verified to be at least 30 percent more energy efficient than homes built to the 1993 national Model Energy Code or 15 percent more efficient than state energy code, whichever is more rigorous. Builders who participate in the ENERGY STAR programs must also sign a partnership agreement with the EPA. As part of that agreement, builders commit to qualifying at least one ENERGY STAR-labeled home within any on-going 12-month period. Builders must also label all homes that are independently verified to meet the ENERGY STAR performance guidelines. Participating programs and builders are authorized to use the ENERGY STAR logo in the marketing and outreach campaigns, subject to the EPA's logo use guidelines.

The EPA requires a third-party verification process to prevent abuse of the ENERGY STAR label (i.e., the labeling of homes that do not meet the performance standard). The EPA has also established a minimum requirement sampling protocol that allows third-party verifiers to randomly test and inspect a minimum of 15 percent of a group of participating homes located within the same climate region (typically the same subdivision). Several R8 Programs implemented more stringent sampling policies.

Brief overviews of the R8 Programs follow.

The 2001-2002 Austin Green Building Program implemented by Austin Energy (Austin Green Building), the local municipal utility, was *not* structured around ENERGY STAR. Rather, it employed a membership structure requiring participating builders and architects to make a commitment to build "green" in order to join. The program also provided associate memberships for manufacturers, suppliers, and real estate agents who were associated with green building techniques and materials. Austin Green Building rated members built and designed new homes and remodels in the Austin Energy service area using "green" guidelines on a scale of one to five stars: the more stars the more green features in the home. Homes were rated in five areas: energy efficiency, water efficiency, materials efficiency, health and safety, and community.

In addition to new home ratings, member services included consultation services, marketing support, listing in the directory of Green Building professionals, and monthly training seminars. The program also co-sponsored the annual Cool House Tour with the Texas Solar Energy Society and made presentations to interested community groups. Austin Green Building also offered a variety of information resources to members and the general public including the

Sustainable Building Sourcebook, Green Building Newsletter, Green Home Buyers Checklist, and BEST Case Studies. In 2001–2002, the program rated almost 400 homes (21 percent market share) and provided code enforcement for 1,849 single family and 3,863 multi-family units.

The 2002 California ENERGY STAR New Homes Program (CA ENERGY STAR New Homes) was implemented by the four largest investor-owned utilities (IOUs) in California: Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), Southern California Gas Company (SCG), and San Diego Gas & Electric Company (SDG&E). This ENERGY STAR-affiliated program was designed to encourage single-family and multi-family builders to construct homes that exceeded California's energy standards by at least 15 percent through a combination of financial incentives, design assistance, and education. Program requirements addressed overall building energy performance, AC efficiency, furnace efficiency, AC sizing, window performance, and duct design. The program design emphasized consistency across utility service territories by using identical program applications, incentive amounts and eligibility requirements. In 2002, the California utilities certified 20,515 new homes as ENERGY STAR Homes, which represented a 12.8 percent market share.

The 2002 New Jersey ENERGY STAR Homes Program (NJ ENERGY STAR Homes) implemented by the New Jersey Clean Energy Program was also affiliated with the ENERGY STAR program. To receive certification as a New Jersey ENERGY STAR Home, a home had to score 86 out of a possible 100 points on the Home Energy Rating System (HERS), equivalent to 30 percent better building performance than the Model Energy Code. In addition to the basic ENERGY STAR requirements, there were specific program requirements for central air conditioners and/or heat pumps (when installed), ducts (when installed) and house air sealing.

In order to ensure a home met program requirements, a utility representative worked with the builder to select the appropriate mix of energy-efficiency upgrades and to ensure proper building practices were followed. In addition, the utility provided technical advice during construction visits and performed a final rating after the home was completed to check all systems and certify the home as an ENERGY STAR Home. In 2002, 1,828 homes were certified through the program, with an average estimated impact of 1,784 kWh and 1.87 kW per home. The 1,828 homes certified in 2002 represented a market share of approximately 6 percent. In addition, 10,633 new homes were committed for future certification.

The 2002 Texas ENERGY STAR Homes Program (TX ENERGY STAR Homes) implemented by Oncor was also affiliated with the EPA initiative to encourage builders to produce ENERGY STAR-rated single-family homes. The program budget included incentives to builders, marketing, advertising, training and support for HERS raters, and measurement and verification. No direct incentives were provided to end-users (i.e., home owners). In 2002, 6,500 homes were built through the program, with an average impact of 3,800 kWh and 1.14 kW per home. The 6,500 homes built in 2002 represented a market share of approximately 17 percent.

The 2002 Tucson Guarantee Home Program (Tucson Home Guarantee) implemented by Tucson Electric Power (TEP) was a residential new construction program that guaranteed heating and cooling costs and comfort for five years. Program policy stipulated that if the annual cost exceeds the specified cost, the homeowner receives a refund for 100 percent of the exceeded costs. Homeowners also received a guarantee that the utility would install an alternate heating source if the customer was not satisfied with the electric heat pump. Each Guarantee Home customer received a reduced electric rate that ranged from 12 to 22 percent

lower than the standard residential electric rate. Guarantee Homes exceeded ENERGY STAR requirements and received ENERGY STAR certification from EPA. TEP also offered builders on-site training and technical assistance from design to completion. Participation rates for Tucson Guarantee Home and its predecessor programs have increased significantly each year since 1977. There were 5590 participating homes through December 2002. During 2002, 2047 new homes were added representing 32 percent of all new homes permitted in the area. The average demand impact was 2.6 KW reduction per home and the average energy impact was 1,477 kWh reduction per home during the cooling months.

The 2001 Vermont ENERGY STAR Homes Program (VT ENERGY STAR Homes) implemented by Efficiency Vermont was also affiliated with EPA's nationwide initiative. As in New Jersey, participating home builders agreed to build to program energy efficiency standards and have their homes inspected by a HERS rater. The home had to score 86+ on the HERS inspection and include four energy-efficient light fixtures, power-vented or sealed combustion equipment, and an efficient mechanical ventilation system with automatic controls. In 2001, 85 builders participated in the program (15 percent of the estimated total). The program certified 196 homes, representing a 7.5 percent market share.

The 2001-2002 Wisconsin ENERGY STAR Program (WI ENERGY STAR) implemented by Wisconsin Energy Conservation Corporation was a voluntary participation program affiliated with ENERGY STAR. The program helped home builders construct healthy, safe and more durable energy-efficient homes through a process of education, training, technical assistance, and performance testing. In order to convince builders to build tighter homes, the program addressed builder concerns about potential indoor air quality (IAQ) and mold issues associated with tight homes with poor ventilation.

In addition to meeting the national ENERGY STAR Homes program requirements, the Wisconsin program had additional certification requirements that included air tightness, combustion safety, and mechanical ventilation standards. Energy consultants associated with the program conducted three site visits to each house at various stages of construction to verify that the homes met program standards. The consultants also conducted the home energy rating that qualified the home for the national program (rating score of 86 or higher). In 2001–2002, the program certified 612 ENERGY STAR Homes, for a 3.4 percent market share. The program goal was to certify 10 percent of all new homes within five years.

R8 Program summary characteristics are provided in Exhibit R8-1. Additional data and program characteristics are summarized in the remainder of this chapter. Detailed interviews, requesting the same data elements, were conducted with program managers representing each of the R8 Programs. However, not all of the requested data were available or received by the time of this writing. The R8 Study aimed to obtain data for a consistent target program year, selected in consultation with each program manager as the most recent year for which the most complete and representative data were available. While *ex-post* data on actual program expenditures and accomplishments were sought, in some cases only budgeted and planned accomplishments were available at the time of this writing. As a result of the above-listed limitations, not all data fields in Exhibit R8-1 are complete. Issues, limitations, and recommendations associated with data availability and inconsistencies are discussed in detail in other volumes of the Best Practices Study.

Exhibit R8-1
Summary of R8 Program Characteristics

Item	Austin Green Building	CA ENERGY STAR New Homes	NJ ENERGY STAR Homes	TX ENERGY STAR Homes	Tucson Guarantee Home	VT ENERGY STAR Homes	WI ENERGY STAR
Period Reviewed	FY 2000-2001	2002	2002	2002	2002	2001	2002-2003
Context	10+ years of program operation	Statewide ENERGY STAR program since 2002; builds on 12+ years of utility programs	2nd year of program operation	Part of program portfolio mandated by SB 7 (1999)	Mature program; mostly funded by shareholders since 2000	Full-scale implementation since 2000; builds on prior program by Vermontwise Energy Services	In 4th year of 5-year market transformation strategy
Program Budget ($000)	$605	$15,248	$10,945	$5,150	$3,010	$920	$2,870
Total Incentives Paid ($000)	$0	$10,089	$4,430	$4,000	$1,399	$321	$781
Eligible Participants	5,712 Homes	159,573 Units[1]	30,000 Homes	38,000 Homes	6,324 Homes	560 Builders; 1,711 Projects	Unknown
Gross MWh achieved	7,666[2]	10,655	3,262	24,700	3,023	841	1,049
Gross KW achieved	3,630	22,262	3,415	7,410	4,094	278	247
Unique Participants	5,712[3]	18,003 Units	1,828[4]	6,500	2,047	85 Builders, 622 Projects	883[5]

[1] Statewide new home starts

[2] 92 percent of savings are derived from code enforcement activities

[3] Code enforcement for 1,849 single-family units and 3,863 multi-family units. Also includes Green Building ratings for 396 units.

[4] Reflects only certified homes. New commitments total 10,633.

[5] Does not include over 575 participants at Smarter Buildings Smarter Business conference

2. CONTEXT

2.1 POLICY ENVIRONMENT

The R8 Programs incorporated a mixture of resource acquisition (achieving a certain level of kWh savings) and market transformation (marketing and other activities designed to permanently change the market for energy-efficient new homes) approaches. These programs were an outgrowth of new construction initiatives that extend back nearly 20 years.

In many locations, energy efficiency programs emerged largely in response to the energy price spikes of the late 1980s and pressure on utilities from consumer groups and regulators to acquire low cost resources through conservation. These early utility-sponsored programs focused almost exclusively on resource acquisition – using conservation activities to reduce the total load on utility resources and lower future costs.

By the mid-1990s residential new construction programs began focusing on market dynamics in an effort to achieve "market transformation" – using supply and demand to encourage permanent changes in the marketplace for energy efficient products. Program designers increasingly focused on two key components: inspections and related technical support to maximize construction quality; and labeling or branding, along with aggressive consumer education to help home buyers identify the energy efficiency attributes of program homes. This effort coincided with EPA efforts to expand the ENERGY STAR brand to residential new construction.

Austin Green Building was considered to be mature, having evolved through more than ten years of predecessor programs. Funding and staffing have doubled in the last five-six years and the market now shows clear evidence of transformation. Local building policies have generally changed in step with market changes. The City of Austin has incorporated additional policies related to land use and urban run-off and some green elements have become basic requirements. Green building is now a basic requirement for affordable housing projects to earn financial incentives from the City. In Austin, the comprehensive focus on green building rather than just energy efficiency is facilitated by the fact that the municipal utility answers to the City Council, which has responsibility for water and waste water service, solid waste, and land use planning functions as well as electric power delivery. Water conservation and open space preservation have been central political issues for several decades and green building gives policy makers the ability to respond to those concerns without taking a dogmatically no-growth stance.

A downturn in the Austin real estate market in 2000 and 2001 created new program challenges. High-end homes stopped selling, making homes under $250,000 a more important part of the overall market. Builders targeting the lower price ranges were less familiar with the local market, green building technologies and techniques, and with the Austin Green Building program.

CA ENERGY STAR New Homes was an outgrowth of utility residential new construction programs that extend back a number of years. California's efforts to influence building energy efficiency during new construction extend back at least to the mid-1970s with the establishment of building energy efficiency standards, commonly referred to as Title 24. Utility programs

started in the early 1990s. PG&E launched a new construction incentive program in 1990, initially targeted at promoting higher Seasonal Energy Efficiency Ratio (SEER) air conditioners. The 1993 PG&E program added prescriptive incentives for additional measures and encouraged downsizing air conditioners. The utility's 1995-1999 program placed increasing emphasis on home buyer education. Market transformation emphasis in 1996 ushered in an increased focus on market barriers, especially split incentives, first costs, and home buyers' inability to identify energy-efficient homes. In 2000, the program was further redesigned to address AB 970 and Title 24 changes, which were enacted in response to the energy crisis of that year. The revised program encouraged the use of tight ducts, higher EER AC, condensing furnaces (>90 AFUE), high performance windows, Air Conditioning Contractors of America (ACCA) duct design, thermostatic expansion valves, and radiant barrier roof sheathing. In 2001, California's official demand side management (DSM) policy reverted back to resource acquisition. In 2002, the programs of PG&E, SCE and SDG&E merged into a single statewide program under a CPUC mandate. At that point, the program took on the ENERGY STAR brand. California's energy efficiency standards were made stricter in 2001 and will become even stricter in 2005.

Policy changes in New Jersey have tended to follow those in California. On March 1, 2001, New Jersey's State Board of Public Utilities (BPU) approved a plan to establish consistent, statewide energy efficiency programs. Programs are currently implemented jointly by the investor-owned utilities but long-term program administration structure is being shifted to the BPU, with the utilities having no role. In anticipation of the changeover, the BPU limited all program promotion, marketing, and evaluation. One significant change occurred in 2003: Only units to be constructed in designated "smart-growth" areas will be eligible for program benefits.

Program parameters (e.g., requirements, incentives) have not changed significantly since program inception. Some minor changes were adopted for 2004: requirements for mechanical ventilation and a minimum number of ENERGY STAR lighting fixtures. Promotion and marketing affected the program's outcome. By enlisting the state's number one volume builder with a 100 percent commitment of new projects, the program gained new legitimacy and credibility that drew in other major builders and set an example for builders of all sizes. Also, targeting the affordable housing market effectively established program participation as a standard in that market and became a model for the DOE/HUD partnership established in 2004.

TX ENERGY STAR Homes was part of a portfolio of programs implemented to meet energy efficiency goals mandated in 1999 by SB 7, the act that enabled retail electric competition in Texas. SB 7 called for a reduction in statewide energy consumption by at least ten percent of Oncor's annual growth in demand by 2004. The goal was to be achieved through market-based standard offer programs and limited market transformation programs. Energy efficiency in Texas got a further boost in 2001 from SB 5, which mandated energy efficiency to reduce air pollution in areas the EPA has designated as "non-attainment" for air quality. The success of TX ENERGY STAR Homes has been attributed, in part, to the stock market fall and to lower interest rates, which spurred new home construction and contributed to higher participation levels.

Tucson Guarantee Home and its predecessor programs were affected by a number of changes in policy, funding, and marketing. In 2000, the Arizona Corporation Commission instituted Renewable Portfolio Standards for Arizona. Most DSM dollars were transferred to this

initiative, leaving very little available DSM funding for programs like the predecessors of Tucson Guarantee Home. TEP made the decision to continue the program, using primarily shareholder funds. As a consequence, shareholder rate of return was an important criterion for continued program funding.

Program design was also influenced by continuing competition with the gas utility, both in the marketplace and in the regulatory arena. Arizona's utility deregulation bill required builders to pay to install gas lines in all homes regardless of whether they chose to use gas services. TEP established a special three-tier electric rate for customers participating in Tucson Home Guarantee and required installation of electric water heaters and electric heat pumps to qualify for it. Because of the popularity of the rate election in TEP Guarantee homes, the local gas company decided in 2003 to refuse installation of gas service in any subdivision that participated in the program.

In Vermont, efficiency programs are implemented by an "efficiency utility" run by the nonprofit Vermont Energy Investment Corporation (VEIC), which is regulated by the Vermont Public Service Board. VT ENERGY STAR Homes was in the early stages of full-scale implementation, with its immediate predecessor having begun operation in March, 2000. Another residential new construction program operated for about two years prior and was implemented by the contractor Vermontwise Energy Services of Rochester, Vermont. In January, 2002, VT ENERGY STAR Homes was merged with Vermont Gas Systems' HomeBase program, with a six-month transition period. At the same time, the program's incentive structure was reduced from two-tier to single-tier.

Vermont differs from some jurisdictions in that most municipalities do not conduct health and safety inspections of new homes, nor do they issue occupancy permits. Vermont's energy standards do not include an inspection/enforcement component. Rather, builders self-certify compliance. An important program objective, then, was to get builders to meet and exceed energy standards.

Wisconsin's statewide energy efficiency program, Focus on Energy, contracted with Wisconsin Energy Conservation Corporation (WECC) to run the Wisconsin ENERGY STAR residential new construction program. The program was envisioned as a five-year market transformation process encouraging builders to supply and consumers to demand energy-efficient homes without subsidies. After three years, the program has been able to reduce incentives for site visits twice and has made significant inroads with state Home Builders Association. (The R8 Study examines the 2001-2002 period, herein referred to as WI ENERGY STAR.)

The program budget was reduced in July 2003 due to State budget shortfalls. At the same time, it was expected that the program would double the number of certified homes and added measure-specific incentives to increase the program's electric load impacts. Cost-cutting measures such as a "performance builder" element to reduce inspection requirements for consistently good builders are currently being examined for the program. Electrotechnology incentives offered through the program may also now need to be pared down. These incentives were introduced in response to increasing pressure to show tangible reductions in electricity consumption. The program has done a good job reducing gas usage. Opportunities for increased electric savings are being investigated.

Residential new construction program policy regarding building energy efficiency standards has far-reaching implications for program design, performance measurement and cost effectiveness. In most cases, energy efficiency programs can only claim energy impacts that are incremental to base levels as defined by state energy standards or the Model Energy Code.[6] Changing standards represent a challenge to program managers because as standards go up, the range of cost-effective strategies for capturing additional savings becomes narrower, incremental savings per project are reduced, and program cost-effectiveness goes down. Ironically, effective program design and implementation is often the very engine driving the increase in standards. By promoting new technologies and practices, programs accelerate their adoption in the construction industry and make it feasible to establish higher building standards with minimal disruption. In this sense, higher standards are a consolidation of industry advances attributable to the programs, which force market laggards to adopt technologies and practices that have already become *de facto* industry standards. Higher standards are the surest sign of market transformation and overall program success.

2.2 PROGRAM STRATEGY AND GOALS

Program managers articulated the following goals and objectives for R8 Programs:

The goal of **Austin Green Building** was to help build better, environmentally-sound homes via transformation of the residential new construction market.

CA ENERGY STAR New Homes was designed to increase energy efficiency levels of residential new construction, both single and multi-family to at least 15 percent over state energy efficiency standards. The program was performance-based, allowing the architect, energy analyst and builder to select measures appropriate to the area of construction.

NJ ENERGY STAR Homes was designed to increase the energy efficiency level of residential new construction in New Jersey to that of the national ENERGY STAR Homes Program. The program recognized and rewarded builders of premium, energy-efficient homes by helping them increase their profits and customer satisfaction while contributing to a cleaner environment.

The goal of **TX ENERGY STAR Homes** was to support Oncor's overall efforts to meet the energy efficiency goal mandated by SB 7. Program objectives, defined by the Public Utility Commission of Texas (PUCT), were to achieve peak demand reductions and/or energy savings through increased sales of ENERGY STAR homes; condition the market so that consumers are aware of, and demand ENERGY STAR homes; and help ensure that builders have the technical capacity to meet this demand. The ENERGY STAR New Home Program is one of several program "templates" that were pre-approved by the PUCT. Oncor selected this program for implementation because of the high level of residential construction activity in the service territory, the significant opportunities for increased efficiency levels in residential new

[6] In contrast, code compliance is a key component of the Vermont and Austin programs. As previously noted, Vermont has no building inspection and enforcement process other than program participation.

construction, prior experience in implementing new construction programs, and the marketing potential of ENERGY STAR.

Tucson Guarantee Home focused on market transformation and education, with the goal of promoting homes that are healthy, safe, comfortable, affordable, and energy-efficient. The program aimed to reduce system peak demand, increase off-peak demand, and increase energy use during non-peak months. The program goal was to gain a 50 percent market share of new homes permitted each year by 2008.

VT ENERGY STAR Homes aimed for both resource acquisition and market transformation. Specific objectives were to decrease electrical energy consumption in the State, increase market recognition of superior construction; increase compliance with Vermont Residential Building Energy Standards (RBES); increase penetration of cost-effective energy efficiency measures; improve occupant comfort, health, and safety (including improved indoor air quality); and institutionalize HERS.

WI ENERGY STAR focused on market transformation, with a legislative mandate to achieve electric savings. The program goal was to certify 10 percent of all new homes as ENERGY STAR Homes within 5 years. In order to convince builders to build tighter homes, the program had to address builder concerns about poor indoor air quality (IAQ) and mold associated with tight homes with reduced natural ventilation.

Barriers and related activities associated with several of these programs are shown in Exhibit R8-2.

Exhibit R8-2
Residential New Construction Barriers and Related Activities

Identified Barrier	Activity
Information and Search Costs	Using an ENERGY STAR platform helps reduce the overall costs to home buyers of identifying energy efficient homes. On the supply side, programs typically offer technical training to help builders and contractors expand their knowledge and expertise relating to quality construction techniques and energy-efficient products.
Split Incentives	Builders perceive their customers to be unwilling to pay extra for energy efficiency. Since builders will not pay utility bills, provide maintenance and up-keep or live in the home, they are concerned about long-term financial and health consequences of their construction practices only if they impact home sales value and the builder's overall profitability. Programs typically addressed this barrier by promoting the ENERGY STAR brand and targeting education efforts to home buyers to enhance the market value of energy efficiency.
Asymmetric Information	For many features, the costs and benefits cannot be evaluated independently and the home buyer must rely on information from the builder's sales agent, which may not be a credible source. Programs offered a credible, objective source of information. Third-party inspections provide solid and credible information about a home's performance and construction quality.
First Costs	Builders are frequently reluctant to pay extra for inspections because they believe their contractors already do good work. Programs offered free or subsidized third-party inspections to verify construction quality.
Product and Service Unavailability	Programs provided training and technical assistance to builders and subcontractors to develop the technical skills needed to construct energy-efficient homes. Some energy-efficient technologies remain generally unavailable or harder to find than conventional alternatives, e.g., high-quality hard-wired fluorescent fixtures in an array of attractive styles. Programs expanded the demand for these products.
Inseparability of Product Features	Home buyers must weigh the value of energy efficiency against a list of competing criteria (e.g., square footage, location, school district, lot size, number of bedrooms and bathrooms, and style). Several programs attempted to make energy efficiency more influential by stressing the relationships between energy efficiency, health, comfort and maintenance considerations.
Organizational Practices and Customs	Programs typically required Manual J calculations for HVAC sizing and encouraged builders to adopt integrated design with their projects. Integrated design mitigates the problem of accumulating design errors associated with conventional practices.

3. COMPARISON OF PROGRAM COMPONENTS

This section compares the R8 Programs across the four major program components used to organize data collection and analysis. These program components are Program Design (including program theory), Program Management (including project management, reporting and tracking, and quality control and verification), Program Implementation (including participation process and marketing and outreach) and Program Evaluation.

3.1 PROGRAM THEORY AND DESIGN

Of the R8 Programs only NJ ENERGY STAR Homes and TX ENERGY STAR Homes had written program theory documents, both in the form of strategic planning documents either filed with or issued by the authorizing regulatory agency. The more important element across all R8 Programs was a thorough planning process that involved multiple stakeholders and leveraged past experience. Most program managers described an iterative process of program design. R8 Program designs built heavily on predecessor program design iterations, updated to reflect empirical conclusions as well as changes in the regulatory and economic context. For example, the PUCT-approved template for residential new construction programs in Texas builds on prior program experience, including Oncor's (then TXU) Energy Checked Homes program and CenterPoint's (then Houston Lighting and Power) Good Cents program, which ran for over ten years prior to SB 7.

Program designers also turned to outside sources of information and ideas for promising intervention strategies, including paid consultants with prior program design experience and focus groups. One program manager reported deriving the inspiration for the program design from a day-long workshop on integrated building science. The workshop inspired her to invite a building science expert to help her revamp the utility program.

A common theme that emerged from discussions of program design was the importance of tailoring the program to local economic and climate conditions. For example, the California construction market is dominated by large-scale builders who build whole subdivisions. In this context, a consistent statewide program helped establish the clout to influence these builders. In contrast, Vermont's construction market is largely made up of small-scale builders who build a handful of homes per year. These builders have different information needs than a large production builder, which they meet through different channels. The exception is the northwestern region of the state, which includes Burlington, the state's largest city. In this region, production builders building 50 to 150 homes per year participate in the program, largely influenced by the combined service partnership with Vermont Gas Systems.

Wisconsin's climate makes shell improvements a higher priority issue than in milder parts of the country. The drive toward tighter shells raises the importance of good ventilation practices to avoid moisture build-up, carbon monoxide build-up, back-drafting, and other indoor air quality problems. Wisconsin also has an active manufactured homes market, which requires a unique outreach strategy.

Despite the variety of climates, regulatory systems, and market structures, a few common themes in program design emerged as noteworthy.

All R8 Programs emphasized whole building performance, as opposed to a narrower measure or end-use focus.

All programs emphasized quality control through on-site inspections and verifications to ensure that homes were built well. There seems to be a consensus that all aspects of the home must be well constructed for the occupant to enjoy the maximum advantages offered by energy-efficient technologies.

R8 Programs emphasized a collaborative partnership approach to builder relationships. In particular, on-site inspections were used as an opportunity to assist the builder with quality control and develop the skills of the builder and his contractors, rather than to engage in heavy-handed program policing.

All programs emphasized branding and labeling as a means of differentiating energy-efficient homes from conventional homes, thus capturing the latent market value of energy efficiency. Many R8 Programs leveraged the ENERGY STAR brand for this purpose. In the absence of branding, home buyers were unable to distinguish well-built homes from poorly built, inefficient homes.

Program designs were largely empirical. Designers drew heavily from previous experience (both their own and others') and used an iterative approach to determine intervention strategies that would be most effective in their market.

Most programs used incentives, at least initially, to overcome builder hesitation about program participation in general and inspections in particular. Over time, as builders have learned to appreciate the benefits of program participation and inspections, programs have been able to reduce or eliminate subsidies.

All programs recognized the importance of both the supply side and the demand side in the market place. Even those programs that primarily or exclusively targeted supply-side market actors helped prepare those actors to market their products and services to home buyers.

Best Practices

Program Theory and Design
• Have a well-articulated theory or program logic. • Link program tactics to the stated theory. • Plan thoroughly. • Involve multiple stakeholders. • Build feedback loops into the program design. • Maintain program design flexibility. • Understand local market conditions. • Use targeted incentives. • Focus first on developing supply-side capacity. • Do not over-promise results.

- **Have a well-articulated theory or program logic.** Even a relatively simple statement of program logic can reveal gaps in program focus or effort and assure that everyone involved knows what the program seeks to accomplish and why.
- **Link program tactics to the stated theory.** Articulating a program theory and structuring program tactics that are in line with it assures that programs are fundable, feasible, and capable of being evaluated.
- **Plan thoroughly.** Leverage prior experience, both locally and around the country. A detailed, well thought-out plan is easier to present and explain to potential critics.
- **Involve multiple stakeholders,** including stakeholders who should theoretically benefit from the program, trade allies whose cooperation will drive program success, and regulators / policy makers who must understand and approve the program design. Get buy-in from planners and implementers through communication and collaboration.
- **Build feedback loops into the program design** to assure that stakeholders continue to provide input throughout program implementation.
- **Maintain program design flexibility** to respond to changing market conditions and address unforeseen challenges throughout program implementation.
- **Understand local market conditions.** A solid understanding of local conditions is vital for recognizing which lessons from other areas transfer to the local market and which ones do not. As much as possible, justify program design with objective baseline market research to bolster design credibility with diverse stakeholders.
- **Use targeted incentives**, at least in the early stages of program roll-out, to reward program participation. Beyond buying down the cost of energy efficiency, incentives help establish the program's credibility in the minds of private-sector market actors who may be reluctant to be the first to try something new. Carefully link incentives to program objectives and overall marketing and outreach strategy.

- **Focus first on developing supply-side capacity** before selling program benefits to demand-side market actors. Make sure builders are able to offer energy-efficient homes before marketing them to home buyers. Make sure raters are fully trained to provide inspection services before requiring builders to use them.
- **Do not over-promise results**. Overly optimistic promises may attract more interest early on but they set the stage for disappointment later. Be prepared to justify all claimed program benefits with objective building science.

3.2 PROGRAM MANAGEMENT: PROJECT MANAGEMENT

The R8 Programs reflected considerable variation in their organizational structures. For example, Efficiency Vermont is, in effect, a regulated utility in Vermont, but rather than being investor-owned, it is administered by Vermont Efficiency Investment Corporation (VEIC) through a contractual relationship with the Department of Public Service. Austin Energy is a municipal utility with an oversight board appointed by the Austin City Council. WI ENRGY STAR was implemented by a nonprofit organization, WECC, under contract to Focus on Energy, the public-private partnership for energy efficiency created in 1998 with the cooperation of the Public Service Commission of Wisconsin (PSC) and the Wisconsin Public Service Corporation (WPS). The most traditional implementation structures are those of the California, New Jersey, Texas, and Tucson utilities, all regulated investor-owned utilities with in-house administration and subcontracted services for their energy efficiency programs.

Despite the observed variation in organizational structure, the R8 Programs exhibited remarkable consistency in their implementing structures and program management arrangements, at least at a high level. Most programs relied heavily on in-house management and administration with varying degrees of reliance on subcontractors to provide inspection and quality control services, marketing and outreach, and training and education. Only one program outsourced implementation to a turn-key contractor.

Exhibit R8-3 shows the different approaches for combined program management and implementation components for the R8 Programs.

The structure of program management appears less important than how well the program activities were aligned with program objectives and market characteristics. Program staff almost universally noted that relationship building, understanding the market and adapting to market shifts was critical to program success. Regardless of the overall project management structure (whether a turnkey contractor, in-house, or with significant subcontracting), program staff repeatedly mentioned the importance of knowing the market within which the program works, respecting the fact that the program is intervening in a market, and investing in the communication required to build relationships with a variety of market actors.

Exhibit R8-3
R8 Program Management/Implementation Approaches

Program	Program Management/Implementation Approach
Austin Green Building	Primarily in-house
CA ENERGY STAR New Homes	Primarily in-house; field inspections outsourced to independent HERS Raters
NJ ENERGY STAR Homes	In-house, with significant private-sector subcontractors
TX ENERGY STAR Homes	In-house, with significant private-sector subcontractors
Tucson Guarantee Home	Primarily in-house
VT ENERGY STAR Homes	In-house, with significant private-sector subcontractors
WI ENERGY STAR	Primarily in-house

Another recurring theme in program staff responses was the importance of clear lines of communication and decision-making to the success of project management. This issue was particularly noteworthy in California and New Jersey, where the programs were jointly implemented by multiple utilities, under a mandate to offer a single, consistent program design statewide. In those states, program management teams with representation from all participating utilities met regularly to address issues and make decisions, usually by consensus. The teams were kept as small as practicable, communication channels were well-defined, and a shared understanding of program goals and objectives facilitated decision-making on operational matters. Utility representatives to the management teams were fully empowered by their organizations to make and implement program decisions.

The importance of sound planning of the program operational plan also emerged as a theme for successful project management. Respondents repeatedly stressed the importance of tailoring the program process to local market conditions and actively engaging stakeholders in its review and testing. Once developed, the operational plan should be pilot tested to identify and resolve any remaining operational issues. Even after taking these precautions, program managers should maintain a degree of flexibility to respond to changing market conditions and unforeseen circumstances.

A final theme was the importance of finding well-qualified staff and contractors and then providing them the training they need to do their jobs. Since interactions with construction industry professionals was such an important part of all program designs, several respondents stressed the need to hire program staff and contractors with actual construction and design experience. One program reported success recruiting raters from the ranks of professionals who perform point-of-sale inspections. They were able to speak with authority about the long-term

consequences of particular construction practices because they had seen those consequences first-hand. They also had a better understanding of occupant concerns.

Regardless of a new hire's previous skills and experience, a certain amount of training was required for the job. One respondent stressed the importance of matching the training to the specific skill sets needed to succeed. The same respondent also highlighted the value of staff performance awards which were linked to performance evaluations with tangible measures that were known in advance and developed jointly by the manager and employee.

Best Practices

Program Management: Project Management
• Include stakeholders in developing a program process or operational plan. • Put the process plan in writing. • Keep management teams small. • Maintain good staff morale. • Make sure at least some of the institutional memory resides in-house, not with subcontractors. • Avoid giving a single contractor exclusive responsibility for program implementation. • Provide staff with good training that matches skill needs. • Reward high performing staff and link performance evaluations to tangible measures which are known in advance and developed together jointly by the manager and employee. • Match staff decision-making authority to responsibilities and delegate responsibility and authority to avoid institutionalized bottlenecks. • Get upper management buy-in.

- **Include stakeholders in developing a program process or operational plan**. Doing so will bolster the plan's credibility and produce a plan that reflects local market conditions and works from the perspective of a range of sometimes divergent viewpoints. A well thought-out plan will contribute to smooth program implementation.
- **Put the process plan in writing** and document all important decisions that inform plan elements. A written plan is more likely to be well thought-out and is easier to disseminate to the various affected stakeholders.
- **Keep management teams small.** Small teams are necessary to maintain close coordination, facilitate good communication, and increase the likelihood of reaching consensus (when multiple entities are involved in decision making).
- **Maintain good staff morale** to ensure staffing stability and develop long-term institutional memory.
- **Make sure at least some of the institutional memory resides in-house, not with subcontractors**. This ensures program stability and increases ability to improve program design over time.

- **Maintain flexibility to respond to changing market conditions and unforeseen eventualities**. Clear-cut accountability and good communication with regulators and stakeholders may mitigate tendencies to impose regulatory requirements that limit flexibility.
- **Avoid giving a single contractor exclusive responsibility for program implementation**. If the program relies heavily on contractors as a strategy to develop private-sector service capacity, it is important to stimulate competition among multiple contractors to promote accountability, provide incentives for cost and quality control, and build in redundancy in the event any one contractor fails to perform. This is particularly important when the contractors delivering program-related services contract directly with other private market actors rather than with the program (e.g., inspectors and raters who contract directly with builders).
- **Provide staff with good training that matches skill needs**. Program services will only be as good as the people who deliver them. Human resources are as important to program success as financial resources.
- **Reward high performing staff and link performance evaluations to tangible measures which are known in advance and developed together jointly by the manager and employee**. Staff will perform better when they clearly understand what is expected of them and they agree that the expectations are reasonable.
- **Match staff decision-making authority to responsibilities and delegate responsibility and authority to avoid institutionalized bottlenecks**. A good balance between authority and responsibilities is a prerequisite for performance expectations that are perceived as reasonable. Delegate responsibility and authority to avoid institutionalized bottlenecks.
- **Get upper management buy-in.** Residential new construction programs require several years to generate tangible impacts. Upper management must embark on the process with patience, reasonable expectations, and a commitment to fund the entire start-up phase.

3.3 PROGRAM MANAGEMENT: REPORTING AND TRACKING

Despite variations in the degree of emphasis on resource acquisition versus market transformation, all R8 Programs had some system for quantifying program performance in terms of energy impacts. For new construction programs, this requires fairly thorough documentation of the project baseline as well as actual building performance. Most programs had a system in place for developing reasonable "deemed savings" values that approximate the actual savings achieved via program participation.

Programs with a more explicit market transformation focus tended to track a wider variety of performance indicators. For example, WI ENERGY STAR tracked builder performance trends (by builder), customer satisfaction, installed technologies, training events for builders, contractors and consultants, and cooperative marketing expenditures. The program also tracks builder "maturity" in three stages based on the following logic model: (1) builder starts by working closely with rater; (2) builder sends subcontractors to trainings; and (3) builder starts marketing program participation as part of the business model.

The array of information recorded supported a number of applications. In addition to the standard functions of regulatory reporting, internal performance monitoring, quality control, and project status tracking, the Wisconsin tracking system supplied concrete information about builder construction quality trends. Consultants used this information for program analysis, and builders were able to use it for their own marketing efforts. WI ENERGY STAR used participation data to determine eligibility to use the program name and brand. Third-party inspectors used tracking system results to help win bids from builders. Several other R8 Programs used tracking systems to initiate communications with participants and trade allies at key junctures and/or set program priorities, goals, and budgets. Austin Energy used its system to evaluate staff performance as well.

The application of computer technology for reporting and tracking was valuable to all R8 Programs, and was used to automate tasks, reduce the tedium of data management, impose quality controls on data entry and processing, and streamline overall program administration. Respondents described early versions of tracking systems that used multiple databases that did not communicate with each other, duplicative data entry protocols that led to inconsistencies, and other data management challenges. The earlier databases have generally been replaced with better designed and better integrated tracking systems.

TX ENERGY STAR Homes had the most thoroughly automated tracking system. Oncor and other Texas utilities have jointly sponsored the development of a Web-based interactive system for use by program administrators, builders, and raters. With this system each party was able to input data and track the progress of a home from the beginning of construction to final ENERGY STAR certification. The database made program participation virtually paperless for the builder. It also eliminated the use of program resources to manually enter program application data, since participants entered it themselves online. The database featured fairly rigorous quality control screens for data entry. Routine functions such as monthly reports and invoice tracking and payment were automated.

Exhibit R8-4 shows the different reporting and tracking methods used by each program. Exhibit R8-5 summarizes the different functions the tracked information served.

Exhibit R8-4
R8 Program Reporting and Tracking Tools

Program	Method
Austin Green Building	The program tracking system met minimum needs (e.g. reporting) but did not support activities such as marketing.
CA ENERGY STAR New Homes	Individual utility tracking systems designed to meet uniform reporting specifications. Systems generally linked to accounting systems. CHEERS tracked information required to coordinate builder/rater interactions.
NJ ENERGY STAR Homes	A combination of utility and contractor databases tracked all program participants, inspection results, incentive qualifications, and installed equipment efficiencies. Contractors had separate tracking systems but both contractors used the same standardized reporting template to maintain consistency.
TX ENERGY STAR Homes	A Web-based interactive database was developed for use by program administrators, builders, and raters. Each party was able to input data and track the progress of a home from the beginning of construction to final ENERGY STAR certification. Oncor and two other utilities also jointly sponsored the development of a software tool to evaluate the kW and kWh savings for ENERGY STAR homes. The HERS software tool allowed a more accurate estimate of energy and demand savings
Tucson Guarantee Home	In addition to the standard tracking and reporting functions, the TEP program database also played a key role in implementing the program guarantee. The database was linked to the customer billing system. At the customer's one-year anniversary, actual bills were compared to the guarantee amount to determine whether the customer qualifies for a billing credit.
VT ENERGY STAR Homes	The program has worked to consolidate and streamline tracking systems. Initially, the program used one database to track leads and projects and another database to track measures. The two databases did not link. More recently, the two have been merged.
WI ENERGY STAR	Program tracked an array of market transformation indicators as well as inputs required to estimate program impacts.

Exhibit R8-5
Reporting and Tracking Functions

Function	Austin Green Building	CA ENERGY STAR New Homes[7]	NJ ENERGY STAR Homes	TX ENERGY STAR Homes	Tucson Guarantee Home	VT ENERGY STAR Homes	WI ENERGY STAR
Reporting to Upper Management / Regulators	✓	✓	✓	✓	✓	✓	✓
Program Impact Calculations	✓	✓	✓	✓	✓	✓	✓
Internal Performance Monitoring / Quality Control / Project Status Tracking	✓	✓	✓	✓	✓	✓	✓
EM&V	✓	✓		✓		✓	✓
Financial Accounting		✓	✓	✓	✓		
Communications with Participants and Trade Allies		✓		✓	✓		✓
Set Program Priorities, Goals, Budget	✓	✓			✓		
Load Research and Forecasting	✓				✓		
Program Marketing Activities		✓			✓		✓
Market Trends		✓	✓				✓
Customer Satisfaction					✓		✓
Staff Performance Evaluations	✓						

[7] PG&E and SCE only

Best Practices

Program Management: Reporting and Tracking
• Define and identify the key information needed to track and report early in the program development process. • Minimize duplicative data entry; link databases to exchange information dynamically. • Track market transformation program qualitative benefits and measures related to spillover effects, along with direct savings impacts. • Develop accurate algorithms and assumptions on which to base estimates of savings. • Design databases to be scalable to accommodate changes in program scope. • Use the Internet to facilitate data entry and reporting. • Automate routine functions such as monthly reports. • Build in rigorous quality control screens for data entry. • Document the tracking system carefully.

- **Define and identify the key information needed to track and report early in the program development process**. Clearly articulating the data requirements needed to measure success in advance ensures the ability to cost-effectively evaluate the program. Early identification of all stakeholders and their information needs allows for effective design of reporting and tracking systems.
- **Minimize duplicative data entry; link databases to exchange information dynamically**. This is especially important if the program uses separate tracking systems for program participation, inspection scheduling and coordination, and customer billing.
- **Track market transformation program qualitative benefits and measures related to spillover effects, along with direct savings impacts**. Residential new construction programs are often more effective when energy savings benefits are linked in to non-energy benefits that are more important to the buyer. Tracking non-energy benefits is an important tool for establishing credible claims. In addition, market transformation strategies are often chosen over resource acquisition strategies for their potential to generate spillover to non-participating market actors and projects. Tracking these spillover effects will help bolster program credibility.
- **Develop accurate algorithms and assumptions on which to base estimates of savings.** Use tracking system results to periodically review deemed savings estimates and bring them in line with actual building performance. This exercise will help set reasonable expectations and avoid the temptation to oversell program benefits.
- **Design databases to be scalable to accommodate changes in program scope.** Doing so will enhance the program's overall flexibility and ability to respond to unforeseen market conditions.
- **Use the Internet to facilitate data entry and reporting.** Internet access is now widespread and electronic data transfer and sharing can greatly enhance the quality and cost-effectiveness of information management. Internet-based systems can help

minimize duplicative data entry and storage and automate many routine quality-control steps.

- **Automate routine functions such as monthly reports**. Doing so provides an opportunity to build in quality control checks and frees staff time for more strategically important tasks.
- **Build in rigorous quality control screens for data entry**. Program the tracking software to reject inconsistent, inaccurate, or incomplete data to minimize the extent of subsequent data cleaning and enhance the accuracy and credibility of reported results.
- **Carefully document the tracking system**, including database structure, data field definitions and screening criteria, and data entry and analysis procedures. Good documentation will help mitigate problems stemming from staff turn-over, especially when the system must serve a variety of users with varying computer skill levels.

3.4 PROGRAM MANAGEMENT: QUALITY CONTROL AND VERIFICATION

The core quality control and verification procedures for all R8 Programs were periodic on-site inspections as homes were being built. Program managers noted a number of benefits to this strategy:

- Protects program brand equity
- Complies with ENERGY STAR program requirements
- Verifies the proper installation of energy savings measures, which enables validation of energy savings claims
- Establishes relations with the builder and trades people
- Provides a quality control service to the builder
- Helps ensure compliance with local energy efficiency codes and standards
- Promotes the application of best practices in construction (e.g., air-tight construction, properly installed thermal insulation, controlled mechanical ventilation, and procedures to minimize the risk of moisture, back drafting of combustion appliances, mold, and durability problems)
- Limits builders' financial exposure to construction defect issues (by providing additional quality control and project documentation)

The inspection programs shared a number of features in common. Programs generally relied on third-party inspectors or raters. This strategy is consistent with the market transformation objective of developing a private-sector inspection infrastructure that can provide these quality control services with minimal public subsidies. In most cases, raters had to be accredited through a Residential Energy Services Network (RESNET) approved rater training program. In many cases, the programs trained or helped train the raters and helped develop the organizational infrastructure to connect raters and home builders. In several areas, raters have organized their own professional organizations to self-monitor, regulate and generally advance their profession. At the national level, RESNET provides this function to raters as well.

A key inspection component was building performance modeling. Builders had to submit model results from approved building simulation software, showing that the homes would perform to specified program standards. Raters then confirmed that key design assumptions were incorporated into construction and confirmed or revised model results for as-built conditions. In many cases, raters also provided visual confirmation of installation quality of key energy-related features.

A number of programs also employed a system of spot checks at construction sites to verify rater results. These spot checks provided an additional layer of quality control, assuring that raters were doing a good job. In many cases, spot checks were conducted by in-house program staff.

Homes were inspected at least two and sometimes three times. Every program required home inspections at mechanical rough-in (prior to drywall installation) and at project completion. Some programs also conducted a separate insulation inspection. Final inspection generally included a duct pressure test, blower-door test, verification of equipment requirements and operation, and HVAC equipment startup.

Most respondents emphasized that inspection visits were first and foremost partnership-building events, and not intended as "policing" activities. It was in the rater's best interest to be the builder's ally for quality control rather than the program enforcer. Of course, a certain degree of tension between a rater's partnering and regulatory role was inevitable. For example, one program noted a potential for conflict of interest when the same agency is the builder's agent for program participation requirements, and responsible for compliance documentation, and conducting inspections and the final plan check.

Builders have generally embraced the inspection process as it provides valuable quality control benefits. Raters often revealed construction or equipment deficiencies unknown to the builder (such as HVAC equipment, windows, and water heaters with energy ratings much lower than the products specified and paid for by the builder) thereby increasing the program's value to the builder.

Virtually every program had some process for differentiating the inspection needs of experienced and inexperienced builders. In some cases, the program began by inspecting a sample of homes and then ratcheting up the inspection requirements if significant failure rates were observed. In other cases, the program started by inspecting all homes and then relaxing the inspection requirements for experienced program builders with a demonstrated good track record.

At least two programs required pre-construction meetings with the builder, key subcontractors and suppliers at which project specifications and program requirements were reviewed. The meetings helped establish clear communication with the builder, considered essential for minimizing the incidence of project failures. The meetings also showed builders the importance of good planning, which contributed to fewer change orders, smoother construction process, and better overall projects.

One program experimented with conducting post-occupancy inspections. The process did not work well due to challenges in obtaining homeowner consent to inspect.

Program Management: Quality Control and Verification
• Treat inspection visits as partnership-building and learning events rather than just regulatory enforcement activities. • Require builder or builder's representative to be on-site during inspection. • Plan to rely on third-party inspectors for quality control over the long-term. • Encourage home inspectors to organize their own professional organization. • Provide timely feedback to builders, home inspectors, and other parties. • Ensure that inspectors have plenty of hands-on construction experience. • Establish a streamlined inspection scheduling process. • Recognize the different inspection needs of experienced builders and builders who are new to the program. • Host pre-construction meetings with the builder, key subcontractors, and suppliers to review project specifications and program requirements.

- **Treat inspection visits as partnership-building events rather than regulatory enforcement activities.** It is in the best interest of both the program and the rater to be the builders' ally for quality control. Use inspections as an opportunity to teach good construction practices and sound building science. Do not just check minimal compliance items off a list.
- **Require builder or builder's representative to be on-site during inspection**. By being present, they can see for themselves the value of the inspection. This requirement reinforces the notion of the inspection as a training/education opportunity rather than program enforcement.
- **Plan to rely on third-party inspectors for quality control over the long-term**. Follow-up inspections of selected projects provide quality control of rater's results and assess the program's influence on the project. The success of a residential new construction program hinges on establishing a trusted brand to identify energy efficient homes in the minds of home buyers. Program credibility and brand equity are valuable components and follow-up inspections help maintain both.
- **Encourage raters to organize their own professional organization** to self-monitor, regulate and generally advance their profession. A well-organized professional organization can provide many of the necessary quality control functions. A robust professional association is an important step toward full-scale market transformation.
- **Provide quick and timely feedback to builders, home inspectors, and other parties.** The construction industry is particularly time-sensitive due to the central role of borrowed capital in most projects. Short feedback loops are important for respecting builder and contractor time constraints and capturing one-time opportunities for positive program impacts.

- **Ensure that raters have plenty of hands-on construction experience**. Raters can offer a valuable service to construction professionals as teachers and mentors. To fill that role, they must understand in detail how buildings are built and the long-term consequences of various material choices and construction techniques. Raters should be able to explain good practices in language the builders and contractors can understand. Finally, explanations that draw on personal experience will be perceived as more legitimate and credible.
- **Establish a streamlined inspection scheduling process** that permits a builder to schedule and receive the required inspections with minimal project delays. Again, due to the high reliance on borrowed capital to finance construction projects, any delays can quickly translate into financial loses. New construction programs must avoid imposing these hidden costs on program participants.
- **Recognize the different inspection needs of experienced builders and builders who are new to the program**. Newer builders need more assistance to master the details of quality construction and understand what the rater will be looking for. Once builders have demonstrated their commitment to quality construction and their ability to apply previously learned lessons, the builder should be able to derive the same program benefits with a lower level of program intervention.
- **Host pre-construction meetings with the builder, key subcontractors, and suppliers** to review project specifications and program requirements. These meetings help establish clear communication with the builder and minimize the incidence of project failures. The meetings also show builders the importance of good planning, which contributes to fewer change orders, smoother construction process, and better overall projects.

3.5 PROGRAM IMPLEMENTATION: PARTICIPATION PROCESS

Because all the R8 Programs featured on-site inspections, coupled with program branding, the participation processes were substantially the same across the board. The general process for ENERGY STAR programs is illustrative:

1. Builder submits project documents;

2. Program staff review documents and calculate initial energy rating. Rating is sent to builder, along with upgrade recommendations to reach required program standards (HERS score of 86 for ENERGY STAR);

3. Builder signs program participation agreements and ENERGY STAR Partnership Agreement;

4. In some cases, program representative meets on-site with builder, site supervisor, HVAC contractor, and insulation contractor to discuss program requirements, recommendations, and inspections;

5. Rater conducts pre-drywall inspection. Builder resolves any compliance issues identified during inspection;

6. Rater conducts post-insulation inspection. Builder resolves any compliance issues identified during inspection;

7. Rater conducts final inspection and testing. Builder resolves any compliance issues identified during inspection;

8. Certification granted based on successful inspection results;

9. Program pays incentive check and builder has access to ancillary program services (e.g., training and cooperative advertising).

The general design theory driving this process is that home buyers are inherently unable to identify and evaluate energy efficiency features of new homes on their own. Those features are typically concealed in the finished home or their performance attributes are difficult to evaluate through casual inspection. Home buyers are understandably reluctant to pay extra for unsubstantiated claims of energy performance benefits. Using an easily recognized brand such as ENERGY STAR to certify high performance homes helps home buyers identify energy efficient homes and properly value the energy performance benefits.

Two of the R8 Programs embraced this general design theory without adopting the ENERGY STAR platform and then extended it in unique ways. Tucson Guarantee Home went beyond simply certifying that a home incorporated certain design features, technologies, and construction practices. The program also guaranteed the cooling and space heating energy performance and comfort of the home for up to five years. If cooling and space heating bills were higher than the guarantee amount, the customer automatically qualified for a bill credit. Furthermore, if the customer was, for any reason, dissatisfied with the performance of the home's heat pump, the utility would replace it with an alternative type of heating system free of charge.

The guarantee amount was derived from a home energy budget, developed via computer simulation at the design stage and verified through the inspection process. The guarantee provided at least two key program benefits: (1) assurances from the HVAC contractor to follow program guidelines for right-sizing the equipment; and (2) a tangible marketing tool to home builders. The builders thus became champions and advocates for the program.

Austin Green Building also embraced the notion of a branding strategy to overcome home buyer information barriers. But the program took an innovative approach in extending the program's building standards to encompass the full range of environmental and health impacts of construction, not just energy use. Specifically, these "green building" elements included program construction practices that improve energy efficiency, reduce natural resource consumption, reduce pollution, recycle construction and demolition waste, conserve water, improve storm water management, produce healthier indoor environments, reduce maintenance costs, and generally result in higher quality, more durable buildings.

The rationale behind this more comprehensive approach was that green building programs can deliver energy benefits comparable to or exceeding those of existing energy efficiency programs; and non-energy benefits of green building address customer needs more directly than energy-only benefits, making green building projects easier to market. While a detailed evaluation of these claims is beyond the scope of the R8 Study, they merit further attention and research.

In some cases, program managers have begun reducing financial incentives over time. The rationale is that as program brands become established, they should deliver increasing market value to participants, which will enable them to recover incremental costs through higher sales values, without public subsidies. In cases where incentives have been reduced, program participation appears not to have been negatively impacted.

The exception to the above rationale is the incremental cost of verification inspections. To date, no program has succeeded in establishing a third-party inspection system that delivers enough market value to permit inspectors to deliver services without subsidies. The one program that does not pay any financial incentives, Austin Energy, handles inspections in-house.

Exhibit R8-6 summarizes the participation tactics of the R8 programs. Exhibit R8-7 displays insights and lessons learned by program staff about the participation process.

Exhibit R8-6
R8 Program Participation Tactics

TACTIC	Austin Green Building	CA ENERGY STAR New Homes	NJ ENERGY STAR Homes	TX ENERGY STAR Homes	Tucson Guarantee Home	VT ENERGY STAR Homes	WI ENERGY STAR
Financial Incentives	None	Single-Family: $400--900/home, depending on performance relative to energy standards and climate zone Multi-Family: $150-$250/unit Incentives targeted 60% of incremental costs. 2003 included design incentive for Multi-Family	Financial incentives covered ~100% of incremental cost Supplemental incentives available for HVAC, lighting, appliances.	$250/home, based on per-home impacts and allowable avoided costs and customer-class incentive caps	Predecessor started in 1997 with $800 / home; reduced cost of electric service installation. Incentives decrease each year and currently TEP provides $500/home.	$100 / home; various incentives for energy-efficient lighting and appliances	Builder incentives for inspections $520 per home; home owner incentives for electro-technologies, based on portion of incremental cost
Program Membership	Builder, Architect, or Designer	Builder	Builder	Builder	Builder	Builder or homeowner	Builder, Rater (contractor "allies" get access to coop advertising funds)
Membership Requirements	Attend the Green Building Basics course, plus 2 technical seminars per year; agree to build to minimum green building standards, provide project ratings for every project in service area	Builder must sign ENERGY STAR Partnership Agreement	Builder must sign ENERGY STAR Partnership Agreement	Builder must sign ENERGY STAR Partnership Agreement	Builder must sign a letter agreement to meet construction standards, undergo inspections and test and repair any deficiency prior to occupancy.	Builder or homeowner must sign ENERGY STAR Partnership Agreement	Builder must sign participation agreement and agree to certify at least 3 homes per year

TACTIC	Austin Green Building	CA ENERGY STAR New Homes	NJ ENERGY STAR Homes	TX ENERGY STAR Homes	Tucson Guarantee Home	VT ENERGY STAR Homes	WI ENERGY STAR
Design Review	Staff reviewed and recommended design enhancements	Program offered design assistance to builders and related players; ran plan check on all projects to verify project viability and qualifications	Ran plan check, developed customized energy upgrade package	Participating HERS raters reviewed designs to determine HERS scores.	Ran plan check to determine compliance with program's thermal requirements, made any recommendations for compliance, calculated Guarantee cost	Ran plan check, developed customized energy upgrade package; included compliance certification for State energy efficiency standards	Ran plan check, developed customized energy upgrade package
On-site Inspections	Mechanical rough-in and final for sampled projects	Periodic inspections, including final inspection, for sampled projects (1/7)	Mechanical rough-in and final for 100% of projects	Periodic inspections, including final inspection, for sampled projects (1/7)	Mandatory on-site preconstruction meetings with new builders; 3visual inspections for 100% of projects; most projects were performance tested including duct test, pressure test and blower door test.	Final inspection required; mechanical rough-in inspection on request	3 inspections required; 100% of projects inspected
Cooperative Advertising	Program promoted builders by name	Program promoted builders by name; provided brochures, yard signs, welcome mats, ENERGY STAR certificates	No	Builders contributed to coop ad budgets, and provided input	Advertising incentives; Program promoted builders by name	Yard signs, welcome mats, ENERGY STAR plaques	Advertising incentives; Program promoted builders by name
Technical Assistance	Periodic training required	Project design assistance offered; periodic training workshops and seminars to builders energy analysts, architects, and mechanical contractors	Yes	Sponsored HERS training; supported local trade association for HERS raters.	Quarterly training programs for builders focus on integrated building science; training sessions for architects, code and fire officials, homeowners	On demand	Periodic trainings

TACTIC	Austin Green Building	CA ENERGY STAR New Homes	NJ ENERGY STAR Homes	TX ENERGY STAR Homes	Tucson Guarantee Home	VT ENERGY STAR Homes	WI ENERGY STAR
Certification Requirements	1-5 stars, based on degree to which project incorporates measures from Green Building checklist and rating system	Exceed Title 24 by 15%	HERS score greater than 86	HERS score greater than 86 and 15% better than local code (IECC).	HERS score greater than 86; meet program standards	HERS score greater than 86; meet program standards	HERS score greater than 86; meet program standards
Bill Guarantee	None	None	None	None	Homeowner guaranteed that home's annual heating & cooling bill will not exceed specified amount	None	None

Exhibit R8-7
Lessons Learned – Participation

Participation Tactic	Lessons Learned
Financial Incentives	• Useful for overcoming builder resistance but not absolutely required • Most useful for off-setting financial impacts of inspection requirements • Best tied to building performance to provide flexibility in meeting program goals. • More mature programs can reduce incentive levels, based on demonstrated market value of homes built and certified to program standards
Program Membership	• Builder participation is key • Participation from architects and contractors also useful
Membership Requirements	• Require builder to sign ENERGY STAR Partnership Agreement or other pledge to build to program standards • Ongoing training requirements for builders, architects, and contractors add value
Design Review	• Offer design assistance to help builders trouble-shoot problematic designs and improve overall home performance at a stage where changes are still cost-effective • Assist with building energy simulations, life cycle cost analysis, Manual J calculations
On-site Inspections	• Inspect mechanical rough-in and final for sampled projects • Design sampling protocol to ease inspection burden on experienced builders with demonstrated track record of performance • Include performance tests; i.e., duct test, pressure test, blower door test
Cooperative Advertising	• Promote program builders by name • Solicit builder input on marketing messages and strategy • Train builder's sales staff
Certification Requirements	• Home certification and labeling is essential for overcoming split incentives and asymmetric information barriers • Certification requires clear-cut inspection process to protect program credibility and brand equity
Technical Assistance	• Offer regular training opportunities • Encourage rates to offer technical assistance as part of inspections; i.e., emphasize role as builder's ally rather than rule enforcer • Engage raters in providing training courses for builders, contractors, architects
Bill Guarantee	• Utility's performance guarantee is effective at overcoming home buyer's uncertainty about expected performance • Bill guarantee provides builder with additional marketing tool, thus creating additional incentive to undergo inspections, document HVAC sizing calculations • Properly structured bill guarantee creates minimal financial risk for utility

Best Practices

Program Implementation: Participation Process
• Establish a robust program brand to differentiate energy-efficient homes from conventional homes. • Offer assistance in preparing and submitting program applications. • Minimize documentation requirements that would entail preparing new documents not already developed in the course of project permitting. • Use targeted incentives. • Link incentives to building performance requirements. • Establish minimum requirements for builders. • Build strategic alliances with equipment manufacturers and encourage them to add their own incentives. • Target measure incentives to home buyers to encourage them to ask for the higher efficiency equipment. • Solicit home inspector input when developing ethics guideline and customer service standards. • Encourage home inspectors to take over training functions. • Develop a technical and procedural manual for builders. • Avoid vague or inconsistent technical standards that do not take into account broader building performance implications. • Offer a bill guarantee. • Extend program construction standards beyond energy features.

- **Establish a robust program brand to differentiate energy-efficient homes from conventional homes.** Brands help capture the market value of energy efficiency and permit home buyers to identify more energy-efficient homes without mastering the technical details of home construction practices.
- **Offer assistance in preparing and submitting program applications**. The level of documentation required to demonstrate whole-building performance can be significant. Construction industry professionals often cite the hassle of program application paperwork as one of the primary barriers to participation.
- **Minimize documentation requirements that would entail preparing new documents not already developed in the course of project permitting.** To the extent that the program can rely on pre-existing documentation to demonstrate compliance with program requirements, it will help minimize the administrative burden associated with program participation.
- **Use targeted incentives.** At least initially, financial incentives may be needed to convince customers to add cost to construction and try techniques that are new to their industries. Construction industry professionals tend to be risk adverse and are reluctant

to be the first to try something new. Beyond buying down the cost of energy efficiency, incentives help establish program credibility and legitimacy.

- **Link incentives to building performance requirements.** Performance-based incentives provide more project design flexibility than prescriptive incentives.
- **Establish minimum requirements for builders.** Do not necessarily accept all builders as participants. The program's market reputation as a trustworthy arbiter of quality and energy efficiency is perhaps its most important asset. Programs can and should impose minimum performance requirements on builders as a way of protecting and enhancing that reputation.
- **Build strategic alliances with equipment manufacturers and encourage them to add their own incentives**. Doing so will leverage existing market forces to enhance and extend program effectiveness.
- **Target measure incentives to home buyers to encourage them to ask for the higher efficiency equipment.** This strategy is particularly useful for technology choices that are frequently left to the buyer, such as light fixtures and appliances.
- **Solicit home inspector input when developing ethics guideline and customer service standards**. Avoid developing detailed policy manuals for raters without their input. Consider adopting a voluntary ethics guideline and voluntary customer standards document. This strategy is particularly relevant if combined with an active, organized professional association of raters. This recommendation seeks to balance the need to protect the program's market reputation with the desire to harness market forces to transform the market.
- **Encourage raters to take over training functions.** Doing so creates additional opportunities for professional advancement as a rater and capitalizes on the field experience raters are already accruing. In this case, an active, organized professional association of raters is helpful but not a prerequisite.
- **Develop a technical and procedural manual for builders**, including step-by-step participation checklists and comprehensive inspection forms. The intent of these manuals and forms should be to make participation as straightforward, routine, and predictable as possible. It also reduces the degree of "hand-holding" program staff must provide to help the builders through the process.
- **Avoid vague or inconsistent technical standards that do not take into account broader building performance implications**. Standards should include clearly defined metrics that are closely aligned with program goals.
- **Offer a bill guarantee.** Experience indicates that a properly structured guarantee can be a low-cost strategy that greatly enhances the credibility of program benefit claims.
- **Extend program construction standards beyond energy features**, to the extent that benefits from the additional elements can be supported by building science and cost-effective increases in consumer demand. Home buyers are shopping for an array of building attributes. Coupling energy efficiency with other more desirable attributes can enhance program appeal.

3.6 PROGRAM IMPLEMENTATION: MARKETING AND OUTREACH

The R8 Programs all included significant marketing and outreach components to both supply-side market actors (especially builders and contractors) and demand-side market actors (primarily potential home buyers). Program goals generally consisted of increasing builder participation in the program, increasing awareness of program brand (e.g., ENERGY STAR) among potential home buyers, and stimulating both supply of and demand for energy-efficient homes. Marketing and outreach was particularly important for the Austin programs, since it relied exclusively on education and information to achieve program goals. The program offered no direct financial incentives.

Supply-Side Strategies

Direct contact with builders, contractors, and other supply-side market actors proved key to successful outreach efforts. Virtually all R8 Programs recruited builders through a combination of phone, mail, and e-mail contacts, in-person visits, and long-term relationship building. Successful outreach often involved identifying one or more champions within the builder organization to promote and sustain program participation from within. For larger volume builders, it was generally necessary to reach multiple departments within the builder's organization including marketing, finance, construction, and purchasing.

Proactively taking program information to the builder rather than waiting for the builder to seek it out was also an important guideline for successful marketing. Builders tended not to contact program staff of their own volition, creating the need for a "push" rather than or in addition to a "pull" marketing strategy. Programs used an array of strategies to create opportunities to interact with builders including attendance at Building Industry Association (BIA) meetings, sponsorship of golf tournaments and awards ceremonies, participation in trade shows, and home showcase and tour events like Parades of Homes. One program focused particular attention on partnering with the various Home Builders Association (HBA) chapters to bring added value to HBA events. Relations with HBAs were facilitated by the fact that participating builders sat on HBA boards and committees. Trainers at HBA events were program raters.

While not the primary recruiting tools, programs also made use of more generic outreach tools such as Web sites, point-of-sale displays, direct mail, and articles and advertisements in trade publications. Radio, TV, and newspaper ads appear to be of little value for promotion to supply-side market actors.

For the most part, developing leads appears to be a straightforward proposition. The one possible exception may be in markets with a highly fragmented building industry made up of many small builders rather than a few large volume builders. One program in such a market relied on utility service requests to identify leads.

Two programs reported continuing challenges reaching out to realtors. No one reported any particular success in cultivating program champions within this segment.

Demand-Side Strategies

Identifying potential homebuyers was a continuing challenge. Two approaches used by R8 Programs to reach this demand-side market were mass market communications and targeted point-of-sale promotion. A point-of-sale strategy requires a cooperative relationship with the builder's marketing and sales staff. While cultivating these relationships was more time-consuming and sometimes unsuccessful, the pay-off was the ability to communicate specific information about specific homes directly to serious home buyers at a key decision point. Demand-side mass communication strategies were limited to simpler, more generic messages and had to achieve wide distribution to reach the few people actively in the market for a new home.

The R8 Programs appeared to be split in their approach to this challenge. While no program focused exclusively on a single outreach approach, there was considerable difference in the relative emphasis placed on mass marketing versus point-of-sale outreach. Programs with a point-of-sale focus invested considerable effort on sales training for builder representatives and model homes. The builder then took primary responsibility for selling energy efficiency to the home buyer. In many cases, the program complemented builder efforts with cooperative advertising and on-site promotional materials such as signs, welcome mats, flags and brochures.

The programs that emphasized consumer marketing all stressed the importance of understanding the target demographic, tailoring program messages to the audience, and developing effective cross-marketing strategies. Identifying and promoting to pools of likely home buyers was the central theme of this approach and critical to its success. One program targeted its outreach to renters of high-end apartments and condominiums. Another targeted female homeowners age 25 to 54.

Different communication channels have different effectiveness in different markets. One respondent cautioned against newspaper advertisements, stating that they did not provide any additional leads. But another program relied heavily on newspaper ads, along with radio spots, to reach its target audience. Several program managers mentioned radio as a successful marketing channel but stressed the need to be selective in choosing stations that would reach the target audience. Other strategies included locator maps in Sunday newspaper Homes section, billboards and Web sites.

Developing Marketing Messages

Three sources of information drove the development of most marketing messages: prior experience; focus groups and surveys; and standing committees of industry professionals. One program set up a Marketing Advisory Group made up of builders and raters to serve as a sounding board and to help define and refine communication messages. Another program hosted an annual builder conference at which stakeholders could provide suggestions and input.

Regardless of the information source, respondents stressed the importance of understanding the target demographic. Different messages resonate with different audiences. Key messages used by R8 Programs focused on the various benefits of energy efficiency and included:

- Health and quality of life
- Higher quality, comfort, and cost savings
- Environment control, ventilation capacity

One respondent specifically cautioned against relying on a message of "comfortable, durable, combustion safety, energy efficiency" to sell energy-efficient homes. In his experience, homeowners already took those features for granted. At a minimum, there appears to be consensus that messages of energy efficiency and cost savings alone are not sufficiently compelling for most home buyers.

Best Practices

Program Implementation: Marketing and Outreach
• Market to multiple departments within volume builder organizations. • Take information to builders – use a "push" rather than "pull" marketing approach. • Know your target consumer demographic, tailor your message to the audience and develop effective cross-marketing strategies. • Combine point-of-sale marketing via builder sales agents with direct marketing to home buyers. • Give builders an opportunity to participate in developing marketing messages.

- **Market to multiple departments within volume builder organizations**. Marketing, finance, construction, and purchasing departments all have an important role in the planning, construction, marketing, and sales process. Lack of buy-in from any one department can undermine the effectiveness of other department efforts.
- **Take the information to builders – use a "push" rather than "pull" marketing approach.** Don't wait for the builder to come to you. Leverage relationships with professional and trade associations. Create opportunities to interact with your target audience. BIA or HBA meetings, on-site interactions, personal contact, and e-mail offer opportunities to deliver information to builders.
- **Know your target consumer demographic, tailor your message to the audience and develop effective cross-marketing strategies**. These are key elements to consumer marketing. Customer demographics vary widely by region and one-size does not fit all as a marketing strategy.
- **Combine point-of-sale marketing via builder sales agents with direct marketing to home buyers**. Even if the demand-side outreach strategy emphasizes point-of-sale marketing via builder sales agents, a certain amount of direct marketing may be necessary to get builder buy-in. Especially initially, builders need to be convinced that improved energy efficiency can translate into added value at the point of sale. A parallel program marketing effort can help stimulate market demand and demonstrate that added value.

- **Give builders an opportunity to participate in developing marketing messages.** Since the purpose of consumer marketing is to stimulate sales for participating builders, this practice is key to marketing success. Builders have accumulated considerable marketing experience and have a vested interest in messages that are effective and well targeted.

3.7 PROGRAM EVALUATION

The depth and scope of evaluation activities varied dramatically across the R8 Programs, largely in response to varying reporting requirements imposed by management or regulatory agencies. At one end of the spectrum, Austin Green Building and Tucson Guarantee Home had brief annual summaries of program activities and results compiled for implementing agency senior management. Results were drawn almost entirely from in-house tracking systems and were prepared by program staff. At the other end of the spectrum, third-party evaluators were hired to conduct extensive primary data collection and develop *ex-post* estimates of program impacts for CA ENERGY STAR New Homes and WI ENERGY STAR.

In-house staff evaluated tracking system data for **Austin Green Building**. Program staff produced monthly reports summarizing impacts. Every two years, deemed savings values are re-evaluated and updated. Program staff cited lack of resources as a key reason for conducting evaluations in-house, and would have preferred using a third-party evaluator to minimize competing demands on implementation staff time and increase the independence of results.

California's IOUs have sponsored several recent studies of the residential new construction market that have contributed to program design, implementation, and evaluation of **CA ENERGY STAR New Homes**. Studies include *Statewide Residential New Construction Utility Program Comparison Study* (Quantum Consulting, et al. 2000), *Residential New Construction Study* (Regional Economic Research 2001a), *Summary of Findings on New Construction Training Offerings* (Wirtshafter Associates, et al. 2001), *Residential New Construction Demand Impact* (Heschong Mahone Group 2001), *California Residential Efficiency Market Share Tracking* (Regional Economic Research 2001b), and *Evaluation, Measurement, and Verification of the 2002 California Statewide ENERGY STAR New Homes Program* (RLW 2004). These studies characterize the residential new construction market (both single-family and multi-family) in the state, estimate the technical and market potential for savings, and assess key program design components.

The Phase 1 EM&V impact evaluation of **CA ENERGY STAR New Homes** (RLW 2004) estimates *ex-post* energy savings from as-designed project data that has been reviewed and verified by plan check agency. Phase 2 will incorporate as-built information from CHEERS inspections and will add a billing analysis. Evaluation results address program coordination, participation, impacts, building practices, builder awareness, data management and tracking, and quality control. Since the evaluation of the Program Year (PY) 2002 program, there have been increased efforts from CHEERS to address many of the data issues. Also starting in January 2004, CALCerts is a recognized provider of inspection services. The inspection protocols for this program are consistent with protocols developed by the CEC, EPA and ENERGY STAR organizations.

Evaluation activities for **TX ENERGY STAR Homes** and its predecessor programs have included baseline studies, program energy savings, contractor performance, and marketing plan effectiveness. Outside contractors were primarily used to conduct these evaluations.

Evaluation results have led directly to changes in implementation strategy. For example, the marketing plan was modified extensively as a result of evaluation findings.

A baseline study of homes constructed to standard code requirements was first conducted for **Tucson Guarantee Home**. Program technicians installed load research meters in selected participant homes to measure peak demand, compare actual heating and cooling costs to guaranteed heating and cooling costs, and evaluated energy use relative to standard customers. TEP's pricing department conducted a financial evaluation (audit), which looked at internal rate of return, program net present value, and cash flow. The forecasting group analyzed program load impacts for forecasting purposes.

Evaluation results have been instrumental in determining whether the impacts justify continuing the program and whether the bill guarantee appropriately balances risk and reward. Because of on-going evaluation activities, the program became increasingly cost-effective and enhanced the utility's system load profile. Demand was reduced during peak and increased during non-peak hours. The energy use curve shows reduction during peak months and increase in energy use during non-peak months. Actual heating and cooling costs were lower than guaranteed heating and cooling costs in 93-95 percent of the cases. The program cost evaluation led to reduced advertising budget and reduced builder incentives. The evaluation also identified the multi-family sector as one to avoid, due to high rates of free ridership.

A third-party contractor conducted a process evaluation of **VT ENERGY STAR Homes**. DPS performs an annual savings verification and audit to assess VEIC's conformance to its contract with the State. Program impacts were calculated using savings calculations included in the State contract. However, the State's audit team has found that it disagrees with the contractually agreed-upon calculation formulas and has recommended changing the formulas after the fact. A process evaluation of the programs was also conducted which addressed builder awareness of the program, program marketing and outreach, procedural issues, and data management and tracking. In response to evaluation findings, the program started marketing to manufacturers in the housing industry and creating an integrated data system.

WECC conducts in-house impact evaluations of **WI ENERGY STAR**. A third-party evaluator was hired to perform a process evaluation. The process evaluation addressed program procedures, builders' construction practices, and progress toward overcoming market barriers. R&D studies and studies to evaluate technical performance (e.g., furnaces, tight building analysis) were also commissioned for the program. In response to evaluation findings, WECC implemented a high-performance builder mechanism that reduces inspection requirements for builders with proven track records. The program's cooperative advertising component was also expanded.

Best Practices

Program Evaluation
• Support program review and assessment at the most comprehensive level possible. • Ensure that evaluation metrics are in-line with program goals. • Clearly explain evaluation roles and responsibilities to participants in advance. • Select an evaluator who has a detailed understanding of the market context in which a program operates. • Allow for plenty of interaction between evaluators and implementation staff. • Ensure the clarity of the evaluation document. • Periodically review and update market-level information about construction practices and energy efficiency measure adoption. • Periodically review and update algorithms for calculating project savings.

- **Support program review and assessment at the most comprehensive level possible.** For some programs, this will mean a comprehensive market assessment and impact evaluation, for others it may mean a program review document created in-house.
- **Ensure that evaluation metrics are in-line with program goals**. One evaluation objective should be to assess program progress toward achieving pre-determined goals. The only way to accomplish this objective is to establish metrics that measure that progress.
- **Clearly explain evaluation roles and responsibilities to participants in advance**. For example, builders should be informed that an evaluation is expected to include site inspections to avoid any later confusion caused by multiple contractors inspecting the same project.
- **Select an evaluator who has a detailed understanding of the market context in which a program operates.** This will enhance the value of evaluation findings for improving program delivery.
- **Allow for plenty of interaction between evaluators and implementation staff**. This is critical to giving the evaluator a clear understanding of program dynamics. Clear communication channels are essential.
- **Ensure the clarity of the evaluation document.** Regardless of the evaluation scope, it is essential that it clearly describes program goals, strategies and lessons learned so that program staff, stakeholders and other interested parties may gain a good understanding of the program.
- **Periodically review and update market-level information about construction practices and energy efficiency measure adoption**. The degree of sophistication of these market baseline studies will vary, depending on program and market factors. For example, a program operating in a large, highly fragmented market may require a full-scale study to obtain an accurate picture of market conditions, whereas a program in a small or

highly concentrated market may be able to compile a reasonable picture of market conditions through its routine interactions with key market players.

- **Periodically review and update algorithms for calculating project savings**. The objective should be to maintain a set of savings algorithms that are reasonably calibrated with real-world building performance. Depending on the level of precision required and available resources, calibration can involve simply re-estimating key engineering parameters or conducting billing analyses of whole building energy bills.

4. COMPARISON OF OUTCOMES

Energy efficiency programs and portfolios are often designed with specific policy objectives in mind, and those objectives can often impact the outcome of a program. For example, programs that target hard-to-reach areas may not exhibit the same rates of participation as those that do not. Key factors that affect cost effectiveness and program outcomes include:

- **Energy efficiency policy objectives –** policies that emphasize different goals such as market transformation, resource acquisition, equity, etc. will drive different program designs and program objectives.

- **Market barriers addressed** – programs that seek to mitigate difficult barriers may have poorer performance-related metrics because they attack tough problems, in contrast to programs that may have excellent ostensible metrics because of cream skimming.

- **Measure mix** – the mix of measures installed in a program can significantly affect a program's cost-effectiveness.

- **Demand/energy** – the extent of peak demand versus energy focus of the program can, by definition, affect the cost-effectiveness of the indicator in question (e.g., a peak demand oriented program may score poorly on an $/kWh metric). This can be considered a part of the measure mix factor listed above.

- **Multi-year policy objectives** – if consistent, help programs to achieve goals that require medium to long-term market presence and extensive program infrastructure; if inconsistent, make achievement of such goals more difficult.

- **Multi-year funding levels** – if consistent, allow programs to set multi-year goals and maintain consistent presence and messages among end-users and supply-side market actors; if inconsistent, makes maintaining a stable market presence more difficult.

- **Program/Market Lifecycle** – where a program or key measure is in its product lifecycle will affect its cost-effectiveness. For example, a program seeking impacts from the last 50 percent of the market to adopt a product that has penetrated the first 50 percent of the market should be expected to be more costly than one attacking a market with a low or insignificant saturation level.[8]

- **Climate** – for example, HVAC measures are more cost-effective in severe climates than in mild climates because absolute savings are strongly a function of base usage levels.

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[8] There are at least two reasons for this. First, in more highly saturated markets, it is more difficult to find the remaining measure opportunities and, second, the remaining market is typically characterized by late majority and laggard organizations that are more resistant to adopting new products and practices. In addition, a program in the first-year of a multi-year plan to impact a market may have poor first-year metrics because of the associated startup costs and time it takes to create awareness and other program effects.

- **Customer/target market actor mix** – the mix of customers and trade allies often plays a role in cost-effectiveness, for example, a program in a market with larger commercial customers will tend to be more cost effective than an identical program in a market of smaller commercial customers, all other things being equal; similarly, programs with customer segments with longer full-load equivalent hours will be more cost-effective than those with lower average full-load hours of operation (also related to climate).

- **Customer density** – delivering an energy efficiency program to a relatively dense population base will be less costly than delivering to a sparser population, all other things being equal.

- **Customer Energy Rates** – higher electricity rates should lead to higher levels of measure adoption, all else being equal.

- **Economic Conditions** – willingness to invest in new products and practices changes in response to short-term economic and market conditions, which may vary across regions.

- **Customer Values** – efficiency program effectiveness can vary as a function of differences in customer values, again, all else being equal.

Exhibit R8-8 displays cost-effectiveness data for the R8 Programs. Information is presented on the Total Resource Cost (TRC) test, the associated discount rate and the average measure life, where available. The total program cost shown per kWh saved is an indicator related to the utility cost test in that the numerator includes all program costs and excludes any customer contribution to measure costs. Also shown are non-incentive dollars spent per kW, which offers an indication of the cost to market and administer. Incentive dollars per kW shows the overall average incentive amount per unit of estimated first-year impact.

The TRC test is one of the most commonly used metrics to determine if a program is cost-effective. Essentially the TRC is calculated as the ratio of the lifecycle avoided cost benefit of all the energy and demand savings, divided by all of the associated program and measure costs (specifically, full measure costs, not just those covered by incentives). Unfortunately, however, TRC values are not directly comparable across jurisdictions because of the variations in avoided costs, measure cost estimates, measure life estimates, and discount rates mentioned above.

Program planning assumptions can create large variations in both total resource benefit-cost ratios and program costs per unit of impact. Cost-effectiveness is driven by a set of assumptions about measure cost, measure life, per unit savings, savings per application, net-to-gross and other factors. The benefit side of cost-effectiveness is based on avoided cost, which differs substantially across service territories, as noted above. Furthermore, another factor that affects cost-effectiveness is measure mix. The program $/kWh is related to a utility cost test metric.

A comparison of TRC values for **NJ ENERGY STAR Homes and CA ENERGY STAR New Homes** suggests there may be differences in the costs and benefits included in the calculation and the value of those benefits. **NJ ENERGY STAR Homes** shows a much higher TRC despite spending almost twice as much per kWh. The difference may also be attributable to differences in the level of gas savings achieved, which are not reflected in the data in Exhibit R8-8.

Exhibit R8-8
Program Effects[9]

Element	Austin Green Bldg[10, 11]	CA ENERGY STAR New Homes	NJ ENERGY STAR Homes	TX ENERGY STAR Homes	Tucson Guarantee Home	VT ENERGY STAR Homes	WI ENERGY STAR[12]
Period Reviewed	2000-2001	2002	2002	2002	2002	2001	2002-2003
Net to Gross Ratio	NA	0.8	1.0	NA	NA	1.16	1.0
Free Ridership Rate	NA	0.2	0%	NA	NA	NA	0.0
Total Resource Cost/Societal Test	NA	0.57 – 0.94	1.59	NA	NA	1.73	NA
Average Measure life (years)	NA	19	20	>10	20	18	NA
Net MWh (Annual)	NA	8,524	3,262	NA	NA	974	1,049
Gross MWh	7,666	10,655	3,262	24,700	3,023	841	1,049
Net kW (Annual)	NA	17,809	3,415	NA	NA	278	247
Gross kW (Annual)	3,630	22,262	3,415	7,410	4,094	240	247
Real Discount Rate	NA	8.15%	5.24%	NA	6.93%	6.80%	NA
Budget Per Impact							
Program Expenditures ($000)	$604.5	$15,248	$10,945	$5,150	$3,010	$920	$2,870
Incentive Expenditures	$0	$10,089	$4,430	$4,000	$1,399	$321	$781
Program $/first-year kWh saved[11]	$0.08	$1.43	$3.35	$0.21	$1.00	$1.09	$2.74
Incentive Dollars per kWh[11]	$0	$0.95	$1.36	$0.16	$0.46	$0.38	$0.74
Non-Incentive Dollars per kWh[11]	$0.08	$0.48	$1.99	$0.05	$0.53	$0.71	$2.00
Program $/first-year kW saved[11]	$166	$685	$3,205	$695	$735	$3,833	$11,619
Incentive Dollars per kW[11]	$0	$453	$1,297	$540	$342	$1,337	$3,162
Non-Incentive Dollars Spent per kW[11]	$166	$232	$1,908	$155	$393	$2,496	$8,457

[9] Table includes only electric impacts. Several of these programs also claim gas savings, which in some cases may be more significant from a resource value perspective than the electric impacts. The TRC tests should reflect gas resource value, however, the program $/kWh saved figures do not.

[10] Austin Energy only considers first year impacts in its determination of program effects.

[11] Gross impacts only

[12] Table excludes gas impacts, which were an important component of program impacts in 2002–2003.

TX ENERGY STAR Homes is noteworthy for its large savings (24,700 MWh) and its extremely low expenditure per kilowatt-hour saved ($0.21). These results are driven by high savings per home (3.8 annual MWh), which more than doubles the next best program result (NJ ENERGY STAR Homes, with 1.78 MWh per home). Climate may have some bearing on results. While Tucson Home Guarantee (1.48 MWh per home) also operated in a hot climate, the program focused primarily on system load shifting (reducing peaks and filling valleys) rather than energy savings. Austin Green Building (1.34 MWh per home) was an information-only program, which presumably limited its ability to capture energy savings that required significant incremental investment on the builder's part. These results reflect a combination of program baseline, savings estimation methodology, climate, and perhaps average home size. In 2002 Texas had no state energy standards. With the State's adoption of the 2003 International Energy Conservation Code, the modified program baseline produced average per-home savings of 1.7 MWh for the 2003 program year.

TX ENERGY STAR is also noteworthy for its low ratio of non-incentive to total expenditures (22 percent). This result may reflect some efficiencies gained through its Internet-based program administration process. It may also reflect a lower emphasis on in-depth education and training for building professionals and contractors.

CA ENERGY STAR New Homes reported the lowest gross annual savings per home, 0.56 MWh. The result probably reflects, at least in part, a high program baseline driven by state energy standards considered to be the most stringent in the nation. California also places significant emphasis on calibrating modeled energy savings to actual billing histories, which may translate into more conservative impact estimates.

Relatively low demand impacts in Vermont and Wisconsin may reflect lower relative cooling loads on those regions.

Austin Green Building results reflect the fact that 92 percent of claimed program impacts are attributable to code enforcement activities. The other R8 Programs generally use the prevailing building standards as the program baseline, thus excluding code compliance from program benefit calculations. If results for Austin Green Building were recalculated counting only impacts attributable to home ratings (558 MWh and 277 kW), they would show that the program spent approximately $1.08 per kWh saved and $2,181 per kW reduced. Demand reduction expenditures are higher than most other programs but the energy savings expenditures compare favorably to results from most other regions.

In addition to quantitative benefits, program managers reported a variety of qualitative evidence that their programs were achieving the desired market effects.

Austin builders reported that the home buying public is becoming more sophisticated and there is increasing demand for green-built homes. Consumers now ask about volatile organic compounds (VOCs), air conditioner sizing, and dehumidification. Green materials that would be special order elsewhere are standard in-stock items in Austin. More construction projects are rating higher on the subsequent **Austin Green Building** Green Scale, even though the scale itself is getting more stringent. Projects now average 2.3 out of 5 stars. Market actors are now specializing in green building, including an appraiser and a mortgage broker. The Austin program compares favorably to other programs, particularly on the market share metric. **Austin**

Green Building was able to achieve a 20 percent market share for green certified homes without paying direct financial incentives to either the builder or the home buyer.

CA ENERGY STAR New Homes impacts include: a major builder in California has adopted ENERGY STAR standards for all homes it builds; other builders increasingly make it standard practice to build to ENERGY STAR standards. The phase 1 evaluation (RLW 2004) reported high builder awareness of the program (94 percent for single-family builders and 40 percent for multi-family builders). Two-thirds of participating builders report that they now specify energy-efficient measures that they would not have specified prior to program participation.

NJ ENERGY STAR Homes impacts include: a 100 percent commitment from two major builders to build to ENERGY STAR standards. The State has also adopted the New Jersey ENERGY STAR Homes standard for affordable development funding (NJHMFA). Compared to other programs implemented in similar markets, this program has a high program commitment rate with little attrition.

The transformation of the market due to efforts by TEP, including its **Tucson Guarantee Home** and predecessor programs is demonstrated in a number of ways. Over the last seven years inspections have found better installed ducts, better installed insulation, and less over-sizing on HVAC systems. The number of homes that have been successfully certified without repeat inspections has risen over time. Builders now request help and sign contracts in order to take advantage of the quality control testing and inspections rather than choosing not to participate due to the requirements for quality control inspections. Competing utilities now require similar steps for performance and competing programs are now marketed to homebuilders.

A key element of **WI ENERGY STAR** program theory is that in order to convince builders to build tighter homes (a key concern in cold Wisconsin), the program must address builder concerns about poor IAQ and mold associated with tight homes. Prior to the program, builders were already building fairly tight homes but were not providing good enough ventilation. The program taught builders how to build a house as a system. There is a spillover of builders of homes outside the utility service territories who are now paying full price for consultant service inspections. This demonstrates the value of the inspection process and shows that the program addressed barriers and helped builders manage risk.

Wisconsin Home Builder Associations are now taking an increasingly active role in hosting and promoting training programs. The HBAs use program trainings as fundraisers. Training has been very critical to subsequent program success. WECC has also leveraged considerable co-op advertising through its relationships with builders. Over an 18-month period, WECC spent $250,000 on cooperative advertising, which builders matched. HBA is now a partner for the statewide conference. This year the conference drew 100 attendees.

5. SOURCES

Austin Energy. 2003. Green Building Program Web site. www.ci.austin.tx.us/greenbuilder/.

Austin Energy. 2002. *State of the Environment 2002*. Austin Energy. Austin, TX.

Austin Energy. 2001. *State of the Environment 2001*. Austin Energy. Austin, TX.

Barros, Cecelia, Michelle Thomas, David Blanke (Program Managers, Pacific Gas and Electric Company, Southern California Edison, San Diego Gas & Electric). 2004. Best Practices In-Depth Interview, California ENERGY STAR New Homes. January 7.

Clean Energy for New Jersey. 2003. New Jersey ENERGY STAR Homes Program Web site. www.njenergystarhomes.com.

Cummings, Martin. 2002. *Independent Audit of Vermont Energy Efficiency Utility Energy and Capacity Savings for 2000 and 2001*. Montpelier, Vt.: Vermont Department of Public Service.

Douglas, Linda (Program Manager, Tucson Electric Power). 2003. Best Practices In-Depth Interview, Tucson Guarantee Home Program. October 28.

_____. 2003. Personal communication. October 29.

_____. 2004. Personal communication. February 9, May 18.

Efficiency Vermont. 2003. Vermont ENERGY STAR Homes Program Web site. www.efficiencyvermont.com.

Ellison, Steve (Program Manager, Oncor Group). 2003. Best Practices In-Depth Interview, Texas ENERGY STAR Homes Program. September 16.

Energy Center of Wisconsin. 2002. *Energy Savings from the Wisconsin ENERGY STAR® Homes Program*. Madison, Wis.: State of Wisconsin Department of Administration Division of Energy.

Focus on Energy. 2003. Wisconsin Energy Star Program Website. www.focusonenergy.com.

Forbes, Ashley. 2003. *State Implementation Plans: Energy Efficiency Update*. Austin, Texas: Texas Commission on Environmental Quality.

Gobris, Mary Kay (Evaluation Manager, Pacific Gas and Electric Company). 2004. Personal communications. June 21, 23, July 12

Haller, Pat (Marketing Manager, Efficiency Vermont). 2003. Best Practices In-Depth Interview, Vermont Energy Star Homes. October 6, 8.

_____. 2004. Personal communications. August 18, 24.

Heschong Mahone Group. 2001. *Residential New Construction Demand Impact*. San Francisco, Ca.: Pacific Gas and Electric Company.

Morgan, Richard (Program Manager, Austin Energy). 2003. Best Practices In-Depth Interview, Austin Green Building Program. August 19.

Nahn, Greg (Program Manager, Wisconsin Energy Conservation Corporation). 2003. Best Practices In-Depth Interview, Wisconsin Energy Star Program. October 27, November 5.

_____. 2004. Personal communication. August 23, 31.

Oncor Group. 2003. Texas ENERGY STAR Homes Program Web site. www.oncorgroup.com/electricity/teem/starhomes/default.asp

PA Government Services, Inc. 2003. *Focus on Energy Statewide Evaluation: Wisconsin ENERGY STAR® Homes Program: Evaluation Findings*. Madison, Wis.: State of Wisconsin Department of Administration Division of Energy.

_____. 2001. *Focus on Energy II Pilot Study Wisconsin ENERGY STAR® Homes Program: Third Interim Evaluation Report*. Madison, Wis.: State of Wisconsin Department of Administration Division of Energy.

Pacific Gas and Electric Company. 2003a. California ENERGY STAR New Homes Program Web site. www.pge.com/res/energy_tools_resources/efficient_new_homes/.

_____. 2003b. *2003 Annual Earnings Assessment Proceeding, Volume III: Energy Efficiency Programs Annual Report for 2002 and Energy Efficiency Programs Annual Report for 2002 Technical Appendix.* San Francisco, Ca.: Pacific Gas and Electric Company.

Peters, Jane, Shel Feldman, Brian Hedman and Lynn Hoefgen. 2002. *Best Practices from Energy Efficiency Organizations and Programs*. Portland, Ore.: Energy Trust of Oregon.

Quantum Consulting, Inc., Shel Feldman Management Consulting, Megdal & Associates. 2000. *Statewide Residential New Construction Utility Program Comparison Study*. San Francisco, Ca.: Pacific Gas and Electric Company.

Regional Economic Research, Inc. 2001a. *Residential New Construction Study*. San Francisco, Ca.: Pacific Gas and Electric Company.

_____. 2001b. *California Residential Efficiency Market Share Tracking*. Rosemead, Ca.: Southern California Edison Company.

Residential Energy Service Network. 2004. RESNET Program Web site. www.natresnet.org.

Ringhof, Susan (Program Manager, New Jersey Clean Energy Program). 2003. Best Practices In-Depth Interview, New Jersey Energy Star Homes. December 16.

_____. 2004. Personal communications. January 13, February 12, 23, March 24, May 25.

RLW. 2004. *Evaluation, Measurement, and Verification of the 2002 California Statewide ENERGY STAR New Homes Program: Phase 1 Report*. San Francisco, Ca.: Pacific Gas and Electric Company.

San Diego Gas and Electric Company. 2003a. California ENERGY STAR New Homes Program Web site www.sdge.com/construction/newHomes.shtml.

_____. 2003b. *2003 Energy Efficiency Programs Annual Summary and Technical Appendix: 2002 Results.* San Diego, Ca.: San Diego Gas and Electric Company.

Southern California Edison Company. 2003a. California ENERGY STAR New Homes Program. www.sce.com/sc3/011_reb_off/011c_nc/011c1_res/011c1b_bld_dev/011c1b1_energystarhomes.htm.

_____. 2003b. *2003 Energy Efficiency Annual Report, Summary Report: 2002 Results – 2003 Plans and Technical Appendix: 2002 Results.* Rosemead, Ca.: Southern California Edison Company.

Southern California Gas Company. 2003a. California ENERGY STAR New Homes Program Web site www.socalgas.com/construction/energystar.shtml

_____. 2003b. *2003 Energy Efficiency Programs Annual Summary and Technical Appendix: 2002 Results.* Los Angeles, Ca.: Southern California Gas Company.

Stockard, Mike (Program Manager, Oncor Group). 2004. Personal communication. August 27.

Tucson Electric Power. 2003. Tucson Guarantee Home Program Web site. www.tucsonelectric.com/Residential/GuaranteeHome/GuaranteeHome.asp.

U. S. Environmental Protection Agency. 2003. ENERGY STAR Program Web site. www.energystar.gov.

Vermont Department of Public Service. 2003. *Report to the Public Service Board: Evaluation Activities Related to Statewide Energy Efficiency Utility Initial 3-year Contract Cycle (Years 2000 - 2002)*. Montpelier, Vt.: Vermont Department of Public Service.

_____. 2002a. *Report and Recommendations to the Vermont Public Service Board Relating to Vermont's Energy Efficiency Utility*. Montpelier, Vt.: Vermont Department of Public Service.

_____. 2002b. *Report to the Energy Efficiency Utility Contract Administrator: Verification for Efficiency Vermont Year 2001 Savings and Total Resource Benefit (TRB) Claim.* Montpelier, Vt.: Vermont Department of Public Service.

West Hill Energy & Computing, Inc. 2003. *Vermont Residential New Construction 2002: Baseline Construction Practices, Code Compliance, and Energy Efficiency*. Montpelier, Vt.: Vermont Department of Public Service.

Wirtshafter Associates, Inc., Energy Market Innovations, Inc., Kreitler Research and Consulting. 2001. *Summary of Findings on New Construction Training Offerings*. San Francisco, Ca.: Pacific Gas and Electric Company.

Wisconsin Energy Conservation Corporation. 2002a. *Wisconsin ENERGY STAR Homes Builder Participation Agreement*. Madison, Wis.: Wisconsin Energy Conservation Corporation.

_____. 2002b. *2002 Annual Report: Proving the Value of Energy Efficiency*. Madison, Wis.: Wisconsin Energy Conservation Corporation.

Xenergy, Inc. 2003. *Final Report: Phase 1 Evaluation of the Efficiency Vermont Residential New Construction Program*. Montpelier, Vt.: Vermont Department of Public Service.

York, Dan, and Martin Kushler. 2003. *America's Best: Profiles of America's Leading Energy Efficiency Programs*. Washington, D.C.: American Council for an Energy-Efficient Economy.

APPENDIX R8A – BRIEF INTRODUCTION TO THE NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

INTRODUCTION

This report presents results of a comparative analysis of residential new construction programs included in the National Energy Efficiency Best Practices Study ("Best Practices Study"). The overall Best Practices Study objectives, scope, and methodology are briefly outlined in this Appendix. More details on methods and cross-program findings are provided in separate report volumes.

OBJECTIVE AND SCOPE

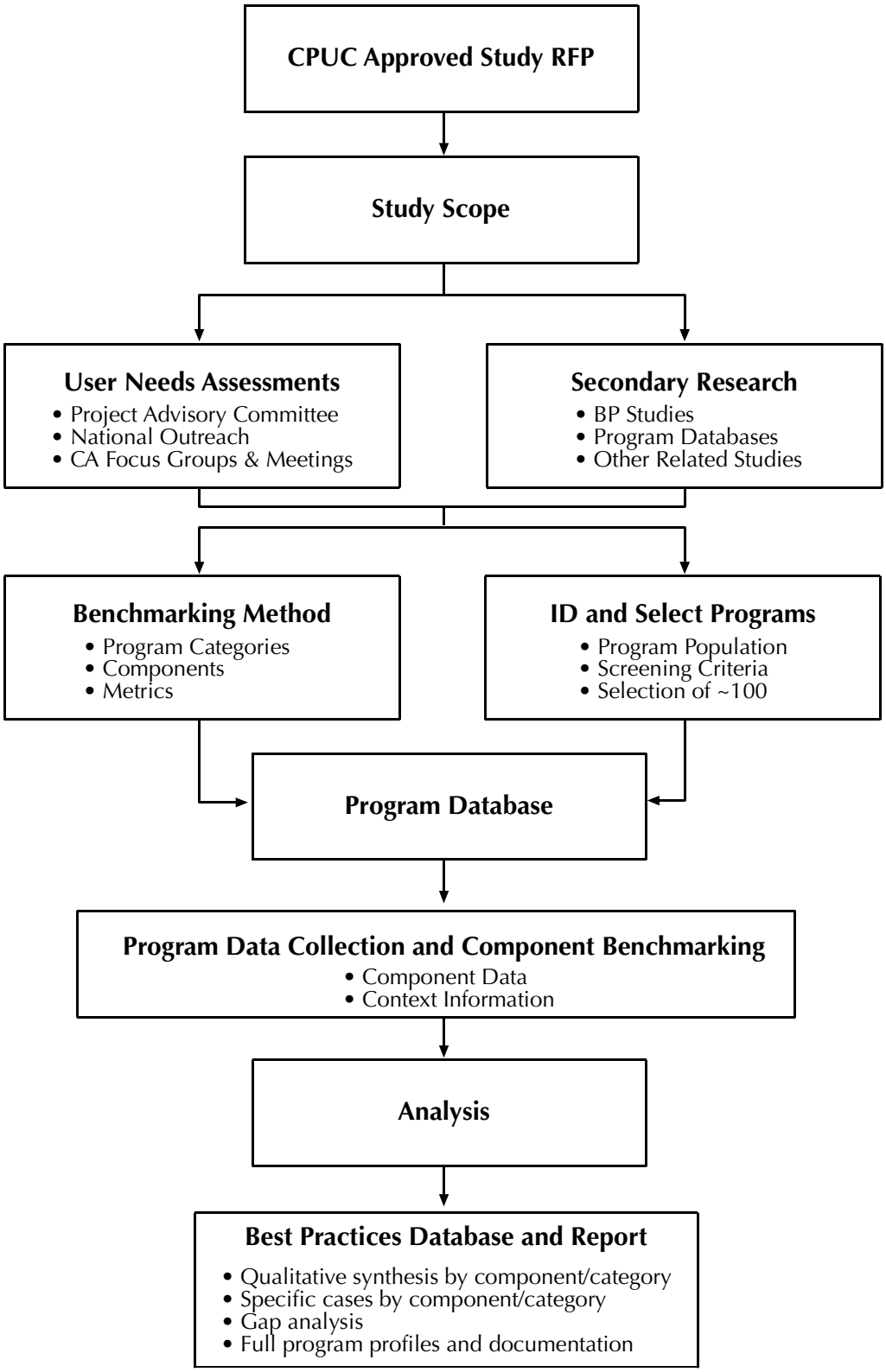
The overall goal of the Best Practices Study is to develop and implement a method to identify and communicate excellent energy efficiency program practices nationwide in order to enhance the design of such programs in California. In particular, program implementers supported through public goods funds are encouraged to use the Best Practices Study's products, along with other resources and their own knowledge and experience, to develop and refine energy efficiency programs.

The Best Practices Study is intended as a first-order effort to identify successful program approaches through systematic cross-program data collection and comparative analyses. It is not intended to produce a census of best practices across all types of programs. Such an approach would be neither practical nor useful given the number of programs that exist; the many differences in policies, goals, and market conditions around the country; the unique needs and market conditions in California; and the importance of encouraging innovation, which by its nature sometimes requires attempting approaches that are not yet proven. If the framework and results of the Best Practices Study prove useful, future phases of the work can expand the number and types of programs covered.

METHODOLOGY

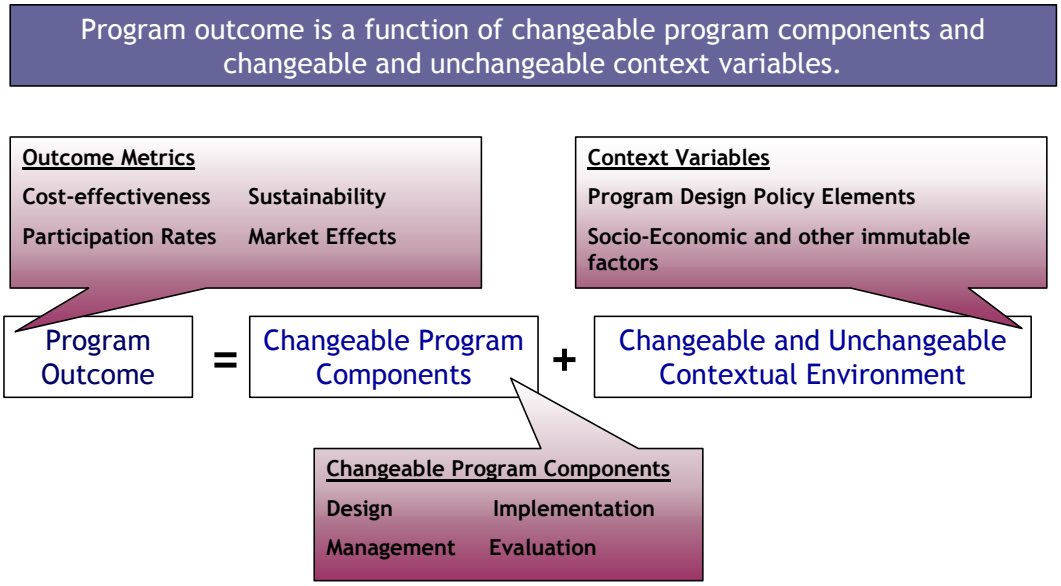
Key aspects of the Best Practices Study include a user needs assessment, secondary research, development of the benchmarking methods, identification and selection of programs to benchmark, development of the program database, data collection and program benchmarking, analysis, and preparation of the best practices report and final database. In addition, outcome metrics will be tracked. An overview of the Best Practices Study key activities is shown in Exhibit R8-9 below.

Exhibit R8-9
Overview of Energy Efficiency Best Practices Study



As shown below in Exhibit R8-10, the outcome of a program – as measured by $ per kWh saved, market penetration or sustainability – can be thought to be a function of changeable program elements, changeable portfolio-level design and programmatic policy decisions, and unchangeable social, economic, demographic, climate, and other factors. All of these factors can influence the ultimate success of an energy efficiency program. Some program elements (such as marketing, tracking or customer service) are directly controllable at the program level and can be modified to affect the success of the program. Other elements (such as the program policy objectives and whether the program has a single- or multi-year funding commitment) may not be changeable at the program level but may be changeable at a policy level. Other elements (such as the physical climate or density of the customer base) are not changeable and cannot be affected by program managers, implementers, or policy-makers.

Exhibit R8-10
Relationship Among Program Outcomes, Components, and Context



PROGRAM CATEGORIES

A program category is defined for the Best Practices Study as the basis for grouping "like" programs to compare across components and sub-components. Program categories may be defined in any number of ways, for example, as a function of target market (e.g., sector, vintage, segment, end use, value chain, urban/rural); approach (e.g., information-focused, incentive-focused [prescriptive; custom/performance based]); objective (e.g., resource acquisition, market transformation, equity), and geographic scope (e.g., local, utility service territory, state, region, nation); among other possible dimensions.

A number of criteria a good program categorization strategy should address were identified and include user accessibility, benchmarking compatibility, potential, compatibility with policy guidelines, and compatibility with scope directives**.** The number of program categories was

limited to approximately 17 to conform to resource constraints. These are shown in Exhibit R8-11 below. The final scheme separates residential from non-residential programs, and distinguishes between incentive programs, information and training programs and new construction programs. Programs are also segregated based on targeted end-use and customer type. A Crosscutting section is included to address comprehensive programs that do not cleanly fall within the other 16 categories. Each program category has an associated code, which is used throughout the Best Practices Study for identification purposes (e.g., R8 Programs = Residential New Construction Programs reviewed for the Best Practices Study).

Exhibit R8-11
Program Categories & Related Codes

Program Category			Code
Residential	Incentives	Lighting	R1
		Air Conditioning	R2
		Appliance and Plug Load	R3
		Single-Family Comprehensive	R4
		Multi-Family Comprehensive	R5
	Information & Training	Whole House Audit with no/minimal incentive	R6
		General & Other Comprehensive	R7
	New Construction Information & Incentives		R8
Non-Residential	Incentives	Lighting	NR1
		HVAC	NR2
		Refrigeration, Motors, Compressed Air, Process	NR3
		Small Comprehensive	NR4
		Large Comprehensive	NR5
	Information & Training	End-Users	NR6
		Trade Allies	NR7
	New Construction Information & Incentives		NR8
Other	Cross Cutting		O1

PROGRAM SELECTION

Programs reviewed for each of the program categories in the Best Practices Study were selected through a three step process. First, programs were nominated using recent best practice studies, team member recommendations. Next programs were randomly selected from published data on energy programs to complete the roster. The third step involved conducting outreach interviews with the staff of nominated programs to determine if sufficient information was available to conduct the research. With the final set of programs determined, in-depth interviews were conducted.

PROGRAM COMPONENTS

The Best Practices Study approach focuses on analyzing programs primarily from the perspective of their changeable program characteristics. The Best Practices Team developed a method for breaking programs down into components and sub-components in order to systematically identify and compare specific program features of importance to overall program success. The four primary program components are program design, program management, program implementation, and program evaluation. These components and their associated sub-components are briefly summarized below.

- **Program Design** provides the initial foundation for a successful program. The program design category has two sub-components: **program theory** and **program structure** (which includes policies and procedures). Good program design begins with good program theory and a complete understanding of the marketplace. Good program structure, policies and procedures are necessary to translate program design theories and goals into practical and effective management and implementation actions.
- **Program Management** is the command and control center that drives the implementation process, and may be broken down into the sub-components of **project management**, **reporting and tracking**, and **quality control and verification**. Project management includes the structure and relationship among responsible parties. Reporting and tracking focuses on approaches to identifying and tracking useful and appropriate metrics that can be translated efficiently into reporting effective information. Quality control and verification includes accountability and improvement processes that are typically carried out through implementation and evaluation activities.
- **Program Implementation** is defined by the actual activities carried out in the marketplace to increase adoption of energy efficiency products and practices. Its sub-components include **outreach, marketing, and advertising**, the **participation process**, and **installation and incentive** mechanisms. Good outreach, marketing and advertising efforts should result in relatively high program awareness, knowledge of program specifics, and participation levels. The participation process is a critically important element of a program's ultimate success. Standard measures of market penetration and customer satisfaction provide one indication of a program's effectiveness at enrolling customers and processing their applications. Installation and incentives should demonstrate evidence of installation and delivery follow-through on marketing and outreach efforts.
- **Evaluation and Adaptability** of programs should also be analyzed. The Best Practices Study assesses the adequacy of evaluation efforts and how programs use evaluation results or other feedback mechanisms to improve over time.

DATA COLLECTION

Program information was gathered using primary and secondary sources. Primary data was collected largely through surveys of program managers and review of regulatory filings, annual reports, and program evaluations. The Best Practices Team conducted extensive interviews with program managers using a detailed survey instrument to guide the conversations. The survey instrument collected information on three main areas: policy context and environment, outcome metrics, and information about program components. The first set of questions elicited

responses on how the program might have been affected by the broader context in which it operates. Next, respondents provided information on outcome metrics, such as program impacts and costs. The remainder of the instrument was devoted to collecting detailed program information for each program component. For each component, respondents were asked to provide factual information on how the program addressed each issue and qualitative judgments about what practices they felt contributed to the success of this program and what practices should have been avoided or could be improved.

STRUCTURE OF REPORTING

Complete project results are provided in project reports and a Web site that allows users to access information at varying levels of depth, including top-line summaries by program type or component, stand-alone chapters on best practices by program area, documentation of project methods, and individual program profiles.