QUANTUM CONSULTING

NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

VOLUME R2 – RESIDENTIAL AIR CONDITIONING BEST PRACTICES REPORT

Submitted to

California Best Practices Project Advisory Committee
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ES. EXECUTIVE SUMMARY FOR RESIDENTIAL AC PROGRAM AREA (R2)

ES.1 INTRODUCTION

This volume presents results of a comparative analysis of residential air conditioning (AC) 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 R2A 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 six residential AC programs for this program area study ("R2 Programs" and "R2 Study," respectively), each of which focused on increasing the efficiency of residential AC through retrofit and natural replacement purchases. Technologies addressed include high-efficiency residential central, room unit, and through-the-wall air conditioners and heat pumps.

Each of the R2 Programs targeted residential high-efficiency AC systems as either a core or an essential element of their program design. The R2 Programs took varied approaches to reaching the air conditioning market. Underlying each program, however, was the concept that incentives should either complement information and training programs or precede them in the market transformation process.

The R2 Programs included direct customer rebates, incentives to upstream market actors, and whole-house approaches with AC efficiency as a program element. Whether targeting end-users or supply-side actors, program planners had a strong preference for financial incentives to encourage market participation. Room air conditioners (RAC) or through-the-wall (TTW) air conditioners, which have a substantially lower total investment and price premium for the high-efficiency option, proved to be the exception to this financial incentive "rule."

The R2 Programs are listed in Exhibit R2-E1 below and presented in the body of this report. A discussion of the program selection process is provided in Appendix R2A.

ES.2 KEY CATEGORY THEMES

Three key crosscutting issues that affect multiple program components were identified for the R2 Programs.

- **Financial Incentives -** Providing financial incentives is key to inducing market actors to seriously consider the core program message (i.e., that supply-side or demand-side actors benefit economically by selling or purchasing high efficiency AC products).

- **Ease of Participation** - Simplifying program processes contributes to rapid ramp up. Each of the R2 program administrators adopted strategies and tools designed to simplify market actor and administrator participation in the program. Examples include online application processes; utilization of barcode tags and barcode reading devices; random,

rather than universal, inspection protocols; and robust information systems for program tracking and management.

- **Incorporation of Practices** - Common among programs targeting split systems is the recognition that maximum efficiency is achieved by properly matching, sizing, and commissioning systems, including proper refrigerant charging. While not all R2 Programs treated installation practices comprehensively, most took steps to ensure that contractors received information and training on installation practices, or that they adequately documented proper installation practices when filing rebate applications.

ES.3 BEST PRACTICES SUMMARY

Best practices are identified in the R2 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 from detailed interviews of program managers and thorough review of all relevant secondary sources such as program filings and evaluations. Exhibit R2-E2 presents the list of best practices developed from the analysis of R2 Programs. The R2 Study also identified some specific lessons learned around the program participation process. These lessons are outlined in Exhibit R2-E3. Exhibit R2-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 the air conditioning element of the California's Statewide Single-Family Rebate Program is in progress and will be published when complete in a separate document.

Exhibit R2-E1
R2 Programs: Residential AC Programs Reviewed For R2 Study

Program Name	Implementer/s	Abbreviation for R5 Report
2002 Keep Cool Air Conditioner Bounty Program	New York State Energy Research and Development Authority (NYSERDA)	NY Keep Cool
2002 California Cross-Cutting Statewide Single-Family Rebate Program, AC Component	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 SW Single-Family AC
2002 New Jersey Clean Energy™ Collaborative Residential AC Component	Conectiv Power Delivery (Conectiv); Jersey Central Power & Light Company (JCP&L); Public Service Electric and Gas Company (PSE&G); Rockland; and Electric Company (RECO)	NJ Clean Energy Res AC
2003 Air Conditioning Distributor Market Transformation Program	Oncor	AC Distributor MT
2001 High Efficiency Heat Pump Incentive Program	Salt River Project (SRP)	SRP Heat Pump
2002 Residential Air Conditioning Program	Florida Power and Light (FPL)	FPL Res AC

Exhibit R2-E2
Summary List of Best Practices for Residential AC Programs

Program Theory and Design
• Develop a complete and well thought-out program plan • Involve multiple stakeholders • Have a well-articulated theory or program logic • Build feedback loops into the program design and implementation process • Include features targeting supply-side actors in the program design • Understand local market conditions • Do not over-promise results
Program Management: Project Management
• Put the process plan, including program management, in writing • Keep management teams small • Include stakeholders in developing program implementation plans • Capture and retain institutional memory in-house • Spread implementation dollars among multiple "implementers," who may be distributors or contractors themselves
Program Management: Reporting and Tracking
• Define and identify the key information needed to track and report early in the program development process • Clearly articulate the data requirements to measure success • Minimize duplicative data entry by linking databases to exchange information dynamically • Conduct regular checks of tracking reports to assess program performance • Develop accurate algorithms and assumptions on which to base estimates of savings • Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions • Automate routine functions such as monthly reports • Build in rigorous quality control screens for data entry • Carefully document the tracking system and provide manuals for all users
Program Management: Quality Control and Verification
• Develop inspection and verification procedures during the program design phase • Consider administrative cost in designing the verification strategy • Provide quick and timely feedback to applicants • Ensure that inspectors have adequate training in identifying and explaining reasons for failure • Use the inspection and verification function as a training tool for the market, especially in market transformation programs • Establish a streamlined inspection scheduling process • Build in statistical features to the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work

Exhibit R2-E2 (Continued)
Summary List of Best Practices for Residential AC Programs

Program Implementation: Participation Process
• Review and understand product availability before establishing product eligibility • Offer personal assistance in preparing and submitting program applications, or provide thorough application procedures manuals or online help tools • Use the Internet to facilitate program participation, include procedures to report installation details • Provide contractors with easy-to-use load software for running the Manual J calculations if these calculations are required • Avoid being the middleman • Keep participation simple • Provide AC contractors training on proper installation practices • Develop a technical and procedural manual for participating market actors • Use incentives to provide the impetus that prompts upstream market actors (contractors, distributors, and manufacturers) to promote high-efficiency air conditioners and customers to consider the high-efficiency alternative
Program Implementation: Marketing & Outreach
• Use the ENERGY STAR® logo to instill consumer confidence • Communicate with customers through multiple media • Cooperate with retailers and contractors to promote the program • Know your target consumer demographic and tailor your messages, incentive structures and promotional messages to the audience
Program Evaluation
• Regularly complete and utilize program evaluation to support program rationale and program design • Develop evaluation metrics that are in line with program goals • Clearly explain to participants early in the process any role they may be asked to play in the evaluation • View evaluation results in the context of the overall market • Periodically review and update market-level information about AC distributor and contractor installation practices and consumer awareness of benefits associated with high efficiency, matched systems, proper sizing and proper installation practices • Periodically review and update algorithms for calculating project savings

Exhibit R2-E3
Residential AC Programs Lessons Learned – Participation

Participation Tactic	Lessons learned
Online Applications	Internet application processing facilitates participation and program management.
Mandatory Proper Sizing and Installation Practices	System efficiency and program cost-effectiveness are improved with proper equipment sizing. Verification of proper sizing and installation (including refrigerant charging) is especially important for programs with tonnage-based incentives.
Contractor/Distributor Training	Training not only helps increase installation efficacy, but also improves contractors' selling skills to help customers assess the benefits of increased HVAC efficiency.
Cooperative Marketing	Leverage dollars whenever possible. Joint or cooperative advertising reduces the administrating entity's marketing costs. Common messages from multiple sources help increase participation.
Regional Coordination	Coordination among utilities operating in a specific region simplifies contractor participation. Common procedures, guidelines, inspection, and invoicing procedures reduce confusion and errors.
Retailer Support/Upstream Buy-downs	Retailer support/upstream buy-downs can exacerbate due diligence issues with regulators – reporting requirements will dictate how simple a buy-down strategy can be. Investment can reduce the price point and have a profound impact in the marketplace.

Exhibit R2-E4
Summary of Best Practices Rationales for Residential AC Programs

Best Practice	Rationale
Program Theory and Design	
Develop a complete and well thought-out program plan	A detailed, well thought-out plan is easier to present and explain to potential critics and avoids unexpected costs during program implementation.
Involve multiple stakeholders	Participation by potential program beneficiaries, trade allies, and regulators/policymakers helps get their buy-in and support. Their guidance ensures the program design theory reflects all facets of market interactions.
Have a well-articulated theory or program logic	This helps identify any gaps in program focus or effort and assures that everyone involved understands program objectives.
Build feedback loops into the program design and implementation process	This assures that program participants continue to provide and receive input throughout program implementation. The effectiveness of such feedback depends on establishing leading indicators of program performance and being sufficiently flexible to respond to feedback.
Include features targeting supply-side actors in the program design	Distributors influence contractors who influence customers. Program managers acknowledged that AC dealers play a pivotal role in promoting high-efficiency AC systems.
Understand local market conditions	This understanding is 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.
Do not over-promise results	Optimistic promises may attract more interest early on but they set the stage for disappointment later. As one respondent said, "Under promise and over deliver."
Program Management: Project Management	
Put the process plan, including program management, 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. This forces planners to more thoroughly think through implementation strategies and provides a mechanism for review by stakeholders. Thorough program implementation plans or policies and procedures manuals facilitate fair and consistent implementation and aid in design of management processes. Program materials must communicate program requirements, yet must be adaptable to changing market conditions and unforeseen challenges throughout program implementation.
Keep management teams small	This allows for close coordination, facilitates good communication, and increases the likelihood of reaching consensus.

Best Practice	Rationale
Include stakeholders in developing program implementation plans	Broad stakeholder input bolsters the plan's credibility, produces a plan that reflects local market conditions, and addresses needs of stakeholders with divergent viewpoints.
Capture and retain institutional memory in-house	Contract consultants provide valuable contributions, bringing outside knowledge and experience. Program managers should institute procedures to retain that knowledge and avoid sending newly gained experience away with the contract consultant when their contract ends.
Spread implementation dollars among multiple "implementers," who may be distributors or contractors themselves	Multiple implementers help stimulate competition, provide a basis for accountability, and build in redundancy in the event any one contractor fails to perform.
Program Management: Reporting and Tracking	
Define and identify the key information needed to track and report early in the program development process	Data needs that are clearly defined early on improve the ability to articulate data collection requirements in time to develop useful reporting and tracking systems in a cost-effective manner.
Clearly articulate the data requirements to measure success	Clearly articulated data collection requirements enhance the prospects that those requirements will be met.
Minimize duplicative data entry by linking databases to exchange information dynamically	This reduces costs and inconsistencies since information is entered in only one database – subsequent data is added to records, It also allows built-in error checking for everyone responsible for collecting or reporting information.
Conduct regular checks of tracking reports to assess program performance	The tracking system must be monitored regularly to be useful. The tracking system is an ideal tool to incorporate variance-reporting features.
Develop accurate algorithms and assumptions on which to base estimates of savings	This helps set reasonable expectations and avoid the temptation to oversell program benefits.
Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions	This enhances the quality and cost-effectiveness of information management, helps minimize duplicative data entry and storage, and automates many routine quality-control steps.
Automate routine functions such as monthly reports	This builds in quality control checks and allows staff time for more strategically important tasks.
Build in rigorous quality control screens for data entry	This minimizes the extent of subsequent data cleaning and enhances the accuracy and credibility of reported results
Carefully document the tracking system and provide manuals for all users	This helps mitigate problems stemming from staff turn-over, especially when the system must serve a variety of users with varying computer skill levels.

Best Practice	Rationale
Program Management: Quality Control and Verification	
Develop inspection and verification procedures during the program design phase	This helps ensure that participants plan to provide required data, typically including nameplate efficiency information, verification or proper installation and commissioning, data related to contractor training and certification, and information regarding disposition of replaced equipment.
Consider administrative cost in designing the verification strategy	Evaluate the incremental cost of additional rigor in verification against the magnitude of risk. High levels of confidence and precision are costly, and inappropriate for low-risk programs (and visa versa). Factor in all related costs, including often overlooked administrative costs, to ensure maximum cost-effectiveness for verification activities. Technology innovations, such as barcodes on recycled units, can streamline verification. Enlisting customers in recording/reporting verification results can also reduce costs.
Provide quick and timely feedback to applicants	Long delays between installation and inspection feedback creates lost opportunities and potential ill will.
Ensure that inspectors have adequate training in identifying and explaining reasons for failure	Program credibility is dependent upon inspectors accurately reporting problems and solutions.
Use the inspection and verification function as a training tool for the market, especially in market transformation programs	The verification process in market transformation programs is less about validating or justifying individual site incentive payments and more about successfully moving the market. Spillover benefits of such programs increase through effective training facilitated by the inspection and verification process.
Establish a streamlined inspection scheduling process	This avoids imposing hidden costs on program participants in the form of project delays. This can more easily be handled through the program management database that allows considerations such as geography or grouping of measures requiring specialized inspectors.
Build statistical features into the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work	Cost control and program success are highly dependent upon limiting inspection requirements while ensuring that inspections are targeted where needed.
Program Implementation: Participation Process	
Review and understand product availability before establishing product eligibility	Constant review ensures that program standards move the market forward without creating demand that significantly exceeds supply (which could result in consumer backlash).
Offer personal assistance in preparing and submitting program applications, or provide thorough application procedures manuals or online help tools	The application process sets the tone for program implementation. User-friendly procedures help generate immediate participant buy-in.

Best Practice	Rationale
Use the Internet to facilitate program participation, include procedures to report installation details	This minimizes the administrative burden associated with program participation.
Provide contractors with easy-to-use load software for running the Manual J calculations if these calculations are required	While proper sizing is integral to achieving optimum efficiency, mandatory load calculation and reporting requirements tend to stifle participation. Tools to facilitate load calculation requirements help eliminate a potential deterrent to participation.
Avoid being the middleman	The customer should have sole responsibility for contracting with the installer, ensuring that all calculations and paperwork are properly completed and submitted. Properly administered, this reduces the number of errors in initial filings and the associated administrative costs.
Keep participation simple	Simplicity is important whether the target is retailers, manufacturers or consumers. Administrators should examine application procedures, reporting, invoicing, inspections and payment procedures to streamline processes. The Internet appears to be a key feature of simplifying program processes.
Provide AC contractors training on proper installation practices	Full system efficiency at manufacturer-rated levels are only realized with accurate sizing, properly matched coils, correct system charging, and thorough commissioning to ensure proper operation. AC contractor training develops these installation skills as well as selling skills, which helps ensure that contractors and utilities deliver the same messages.
Develop a technical and procedural manual for participating market actors	This makes participation straightforward, routine, and predictable. It reduces the degree of "hand-holding" program staff must provide.
Use incentives to provide the impetus that prompts upstream market actors (contractors, distributors, and manufacturers) to promote high-efficiency air conditioners and customers to consider the high-efficiency alternative	This helps 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. Directing incentives to upstream market actors can influence contractor attitudes**.** Since consumers rely heavily on contractor recommendations, programs that influence contractor attitudes will effectively spill over to consumer behavior.
Program Implementation: Marketing and Outreach	
Use the ENERGY STAR logo to instill consumer confidence	Many consumers now recognize the logo and understand its message of assuring the efficiency of labeled products.
Communicate with customers through multiple media	Combine point-of-sale marketing via showrooms and brochures in contractors' trucks with direct marketing to consumers via radio, print and television. Although consumers rely on contractors as their chief source of information, a variety of mutually reinforcing messages via different information sources will be more effective. Customer outreach is also more important for AC retrofit programs and non-AC elements of whole-house programs since the consumer may initiate action independently of the operating condition of the air conditioning system.

Best Practice	Rationale
Cooperate with retailers and contractors to promote the program	Consumers rely on AC contractors as their chief source of information about air conditioning systems. Using them for program promotion is critical. AC contractors can be an effective sales force when the program is designed to align their self-interest with the goals of the program.
Know your target consumer demographic and tailor your messages, incentive structures and promotional strategies to the audience	Customer demographics vary widely by region and one-size does not fit all as a marketing strategy. Consumers increasingly use the Internet to research products and concepts prior to purchase.
Program Evaluation	
Regularly complete and utilize program evaluation to support program rationale and program design	Changing technologies, regulatory requirements and market conditions affect the suitability of any program design. Regular process and impact evaluation ensures that program design matches actual market conditions and produces the savings that management and regulators expect.
Develop evaluation metrics that are in line with program goals	The only way to assess program progress toward achieving pre-determined goals is to establish metrics that measure that progress.
Clearly explain to participants early in the process any role they may be asked to play in the evaluation	This particularly helps customers understand the reason for follow-up calls, surveys or postcards.
View evaluation results in the context of the overall market	Market changes, rather than program failures, may be responsible for unexpected results. Be sure recommendations reflect new market conditions as well as identified weaknesses in program design.
Periodically review and update market-level information about AC distributor and contractor installation practices and consumer awareness of benefits associated with high efficiency, matched systems, proper sizing and proper installation practices	Program design must reflect current market conditions. Program resources should not be expended to promote technologies and practices that are already industry standards.
Periodically review and update algorithms for calculating project savings	In order to provide accurate project savings, savings algorithms should be reasonably calibrated with real-world building performance, which changes over time as construction practices, customer behavior and available technologies change.

1. OVERVIEW OF REVIEWED PROGRAMS

The R2 Programs offered traditional rebate opportunities, bounties for unit turn-in and replacement, as well as upstream training, information and incentives to effect market transformation. All R2 Programs provided incentives for the installation of high-efficiency air conditioning and heat pump systems. Two R2 Programs implemented by utilities were part of a comprehensive building envelope, appliance and AC program. A brief introduction to each of the programs is provided below.

The 2002 Keep Cool Air Conditioner Bounty Program implemented by the New York State Energy Research and Development Authority (NY Keep Cool) provided "bounties" for high-efficiency window and through-the-wall AC replacement. Replaced systems were de-manufactured and recycled. "De-manufacturing" refers to the process of disassembling a piece of equipment so that it can no longer be used for its original purpose. Generally, components were recycled.

The 2002 New Jersey Clean Energy™ Collaborative Residential AC Component (NJ Clean Energy Res AC) was implemented by New Jersey's electric and gas utilities: Conectiv Power Delivery (Conectiv); Jersey Central Power & Light Company (JCP&L); Public Service Electric and Gas Company (PSE&G); and Rockland Electric Company (RECO). The program provided incentives for high-efficiency air conditioner and heat pump installations as well as the proper sizing and installation of new residential systems.

The 2003 Air Conditioning Distributor Market Transformation Program implemented by Oncor (AC Distributor MT) was approved by the Public Utility Commission of Texas (PUCT) and designed to improve AC industry success in marketing, sizing and installing high-efficiency air conditioning systems in Texas. Incentives, training and information/education support were provided.

The 2002 California Cross-Cutting Statewide Single-Family Rebate Program AC Component (CA SW Single-Family AC) was implemented by California's four largest investor-owned utilities (IOUs): Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), Southern California Gas Company (SCG), and San Diego Gas & Electric Company (SDG&E). It promoted energy-efficient envelope, equipment, and appliance upgrades. Rebates of $200 to $700 were available for qualified air conditioning, heat pump, and ground source heat pump systems. The SCG program differed primarily in its targeted measures. Along with efficient envelope retrofits, the program focused on high-efficiency ENERGY STAR furnaces, water heaters, and programmable thermostats.

The 2001 High Efficiency Heat Pump Incentive Program implemented by Salt River Project (SRP Heat Pump) offered an incentive for replacing air conditioning units with high-efficiency heat pumps of 13 SEER or greater.

The 2002 Residential AC Program implemented by Florida Power and Light (FPL Res AC) was an incentive-based program designed to influence the selection of high-efficiency air conditioning and heat pump units. Contractor participation was limited to those contractors

who signed a "DSM agreement" with FPL. To ensure satisfactory and efficient performance, the program had compliance standards for proper installation of equipment.

R2 Program summary characteristics are provided in Exhibit R2-1. 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 R2 Programs. However, not all of the requested data were available or received by the time of this writing. The R2 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. The default target year was calendar year 2002, or the closest corresponding program year. Some programs are not run on calendar years, while others were tracked on a multi-year not single year basis. 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 R2-1 are complete. Issues, limitations, and recommendations associated with data availability and inconsistencies are discussed in detail in other volumes of the Best Practices Study.

Additional limitations in reporting quantitative data arose because air conditioning is often included as component of a more comprehensive program. As a consequence, much of the focus for evaluating air conditioning best practices must be on their qualitative aspects.

Exhibit R2-1
Summary of R2 Program Characteristics

Item	NY Keep Cool	NJ Clean Energy Res AC	Oncor AC Distributor MT	2002 CA SW Single-Family AC[1]	SRP Heat Pump	FPL Res AC
Period Reviewed	2002	2002	2003	2002	May-Oct 2001	2002
Context	Entering 5th Program Year	6th of 7 year Market Transformation Process	3rd year of program implementation	2nd Year as Direct Customer Incentive Program	This was a one-time program implemented in response to the 2001 market issue	The program has a fairly long history. Recent changes reflect higher SEER baselines and reduced incentives
Ave. Retail Elec. Price per kWh[2]	$0.13	$0.104	$0.08	$0.14	$0.07	$0.08
Program Budget	Not Available (NAV)	$24,218,000	$ 5,885,108	NAV	NAV	$18,048,000
Total Incentives Paid	$11,572,350[3]	NAV	$2,302,890	$4,912,891	NAV	$16,859,000
Net MWh goal	NAV	NAV	19,957[4]	NAV	NAV	NAV
Net kW goal	NAV	NAV	5,905	NAV	NAV	NAV
MWh Achieved	27,208[5]	NAV	13,478	8,399	NAV	78,957
kW Achieved	44,813	NAV	10,800	NAV	NAV	37,360
Unique Participants	154,298	NAV	11,200	25,797	NAV	65,055

[1] Program budget for the full program, including non-HVAC measures, are reported in Best Practices Study Volume R4: Residential Single-Family Comprehensive Weatherization Best Practices Report. Figures reported here are for the following measures: Central AC, Heat Pump, Room AC, Evaporative Coolers, and Whole House Fans.

[2] Based on Table 14: Class of Ownership, Number of Bundled Ultimate Consumers, Revenue, Sales, and Average Revenue per Kilowatt-hour for the Residential Sector by State Utility, 2002, Energy Information Administration, Data Tables (http://www.eia.doe.gov/cneaf/electricity/esr/esr_tabs.html). The New York and New Jersey values are statewide averages. California is the average of the three electric IOUs. TXU Retail is presented as a proxy for Oncor's residential average revenue for all retail providers.

[3] NYSERDA figures were inferred from information reported in New York Energy $mart Program Evaluation and Status Report, May 2003.

[4] Oncor AC Distributor MWh and kW goal figures are "gross." Oncor's goal was expressed at the customer meter.

[5] Including "spillover effects," the total market impact is estimated at 42 GWh and 69 MW.

2. CONTEXT

2.1 POLICY ENVIRONMENT

AC incentive programs have been a mainstay of residential energy efficiency programs since the earliest days of demand-side management (DSM). Since the 1970s, the biggest changes have focused on constantly increasing baseline efficiency and an evolving understanding of the important role of contractors, distributors and manufacturers. These supply-side players strongly influence sizing, matching of system components, installation (including installation of the air distribution system) and commissioning.

The typical natural replacement event for AC occurs when a system burns out, which tends to occur when the system is under the most stress during the hottest part of the cooling season. At that point, replacing the burned-out system with a functioning one becomes an urgent priority and energy efficiency considerations are often overlooked. Educating the consumer in that context is a challenging proposition, providing the impetus to focus on supply-side actors.

NY Keep Cool's predecessor began in 2000 as a pilot in reaction to the considerable demand issues in the Consolidated Edison New York City territory. Statewide implementation followed, with participation exceeding expectations by roughly nine times. The combined effect of prior incentives and a sister advertising/promotion campaign has allowed a reduction in incentives from an initial $75 per room unit to $35.

In addition to the program's success in reducing demand, there are measurable changes in consumer behavior, an additional program goal. Consequently, NYSERDA believes they may be able to transition away from incentives and rely solely on education and promotion.

New Jersey utilities have been running incentive programs since 1983. The statewide New Jersey Clean Energy Collaborative began in 2001. At that time, utilities started using common branding and a consistent marketing approach. Before 2001, utilities had the same rebate structure but different program designs. The state is taking a more active role in energy efficiency, which has led to some discontinuity in program delivery. In 2003, evaluations and marketing efforts were halted, pending a review of New Jersey's program administration structure.

Oncor's AC Distributor MT program has a shorter history, having begun in 2001, but appears equally well established in the marketplace. At this point, there is increasing pressure on non-participating distributors to join the current effort. Program goals and incentive levels have been relatively constant.

The Oncor programs are the result of Texas' restructuring process, which separated generation and electricity retail marketing from transmission and distribution and established a statewide energy efficiency goal for the wires companies. Oncor follows a program template approved for all affected utilities by the PUCT. AC Distributor MT was one of several programs produced through a collaborative process involving all key stakeholders through an Energy Efficiency Implementation Project (EEIP).

Since initial implementation, the EEIP has produced three basic changes to the program template based on input from stakeholders: removing the requirement to return load calculations has reduced paperwork and increased participation; allowing administrators to contract directly with dealers provided more incentive for distributors to stay involved with the program; and allowing all 13 Seasonal Energy Efficiency Ratio (SEER) units, not just ENERGY STAR models, has increased the number of eligible units.

The energy crisis of 2002 made a substantial impact on the California programs. Among consumers, it produced a spike in conservation-oriented behavior and led to an increase in energy efficiency awareness, especially of ENERGY STAR products and measures. As the urgency of the crisis has abated, customer interest in energy efficiency has waned, though it has not dropped to pre-crisis levels.

The energy crisis also produced program changes through the regulatory process. Prior to 2001, the Single-Family Program operated as a contractor-driven program, reflecting the State's policy promoting market transformation. In 2001, California's official energy-efficiency policy reverted back to one of resource acquisition. In 2001, the California Public Utilities Commission (CPUC) issued a directive calling for increased incentive funds and reduced administration costs, and the program design changed to a direct customer incentive approach. The directive also set forth formal hard-to-reach (HTR) requirements mandating that one-third of rebate applications come from HTR customers. This new approach, coupled with reduced consumer demand, resulted in modest program performance in 2002. The program met therm savings targets, but failed to reach energy savings and demand reduction goals.

Salt River Project initiated SRP Heat Pump in direct response to the energy crisis in 2001. It was developed in only four weeks and was operated just during the cooling season (May to October) of that year. The program objectives were to reduce system peak demand and help customers save money on their energy bills.

Florida Power and Light's residential AC program is well established and has undergone relatively little design adjustment in recent program years, other than routine adjustments to the incentive levels. In June 2000, AC units with multi-speed and variable-speed compressors became eligible for the program, and the minimum program qualifying equipment efficiency was raised from 11.0 to 11.5 SEER. Rebates for heat pumps were decreased by about 30 percent in March 2002. Air conditioner incentives were also adjusted downwards, but by a smaller amount. This does not appear to have affected the program's performance.

2.2 PROGRAM STRATEGY AND GOALS

The R2 Programs used a mix of resource acquisition and market transformation strategies. All of the programs had market transformation components, though not all were defined as using market transformation strategies. The hallmark of a market transformation program is the use of "a strategic approach to intervening in the market to achieve lasting energy efficiency" (Sebold et al. 2001). Market transformation also includes the identification of specific barriers to adoption of energy efficiency and clear strategies to overcome those barriers permanently (Eto et al. 1996**).**

Each of the R2 Programs identified specific barriers to both end-users and supply-side market actors that program activities sought to address. All of the R2 Programs focused on various end-

user barriers related to information and search costs, product unavailability and overcoming the higher initial cost of efficient products through rebates and marketing designed to expose consumers to the value of energy-efficient product features. And all of the R2 Programs also focused on overcoming various market supply-side barriers related to organizational practices or customs and product unavailability.

Many of the consequences of market barriers overlap, as do potential levers to overcome them. Therefore, several barriers may be addressed with the same activity. The major barriers identified by R2 Program representatives and the activities that may help to overcome them are described in Exhibit R2-2. This is not to suggest that these are the only or even the most important barriers to AC decisions. Rather, these constitute the current view of important barriers to the adoption of residential AC products as described by program manager interviewees and associated program filings and evaluation reports.

Exhibit R2-2
Residential AC Barriers and Related Activities

Identified Barrier	Activities
Information and Search Costs	Bill inserts, newsletters and media and enlisting the distributor/contractor market in explaining benefits to consumers help overcome barriers to information for consumers. ENERGY STAR label and "preferred contractor" programs help consumers identify good equipment and qualified contractors. Contractor information barriers are addressed through training on sizing, proper installation (including refrigerant charging), and duct sealing and repair.
Product Unavailability	Incentives and marketing help encourage stocking of high-efficiency products.
High Costs	Incentives help buy-down the incremental cost. Over time, as other strategy elements begin to take effect, targeted efficiency levels and practices, become more commonplace, and incremental costs decline, the rebates can be reduced or shifted to new products and practices.
Performance Uncertainties	Use of the ENERGY STAR logo instills confidence. Consumer and contractor education on efficiency benefits encourages consideration of the life cycle benefits of high-efficiency equipment.
Organizational Practices and Customs	Training for supply-side actors (sales personnel and installers) on what constitutes best practices helps unseat long-held customs.

The barriers identified by the program representatives reflect the understanding of the residential AC market at the time R2 Programs were designed. It is not always easy to determine whether a specific activity offers sufficient leverage or is the most effective activity possible or even which barriers should be priorities.

Some R2 Programs also used residential AC programs as a resource acquisition strategy. As defined by the Framework document (Sebold et al. 2001), resource acquisition uses "trackable (to the individual program participant and measure), measurable, cost-effective investments in energy efficiency to replace generation energy, transmission and distribution capacity." Oncor, for example, had a clearly stated kW and kWh goal for AC Distributor MT. All of the R2 Programs were designed to demonstrate trackable investments in energy efficiency at the individual program participant and measure level, irrespective of whether they had stated goals.

3. COMPARISON OF PROGRAM COMPONENTS

This section compares the R2 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 R2 Programs, only NJ Clean Energy developed a formal program theory document prior to program design and implementation. The document established core design criteria of having one statewide program that is seamless to the consumer and contractor and having a best practice orientation with uniform rebate levels. The program theory was developed from a market study sponsored by Public Service Gas and Electric examining residential new construction practices. The study identified potential savings from improved AC equipment efficiency and improved sizing and installation practices. The Northeast Energy Efficiency Partnerships (NEEP) residential AC working group reviewed research results, formulated market barriers, and helped developed a program strategy for New Jersey, building on prior residential AC programs in the state.

Other R2 Programs were supported with a variety of program implementation manuals, design templates, and policies and procedures manuals. In both California and Texas, key program theory aspects are articulated in regulatory policies. CA SW Single-Family AC and NY Keep Cool both developed detailed implementation plans, which articulate the underlying program theory.

The overarching program theory for all the R2 Programs was the suitability of incentives to encourage participation by market actors, whether on the supply or demand side. Although the best target for incentives could not be ascertained based on program success, it was clear from articulated program theory and design considerations that involving upstream market actors, including installers, contractors, distributors and manufacturers, is key to success.

Best Practices

Program Theory and Design
• Develop a complete and well thought-out program plan • Involve multiple stakeholders • Have a well-articulated theory or program logic • Build feedback loops into the program design and implementation process • Include features targeting supply-side actors in the program design • Understand local market conditions • Do not over-promise results

- **Develop a complete and well thought-out program plan.** A detailed, well thought-out plan is easier to present and explain to potential critics and avoids unexpected costs during program implementation.

- **Involve multiple stakeholders.** Participation by potential program beneficiaries, trade allies, and regulators/policymakers helps get their buy-in and support. Their guidance ensures the program design theory reflects all facets of market interactions.

- **Have a well-articulated theory or program logic**. This helps identify any gaps in program focus or effort and assures that everyone involved understands program objectives.

- **Build feedback loops into the program design and implementation process.** This assures that program participants continue to provide and receive input throughout program implementation. The effectiveness of such feedback depends on establishing leading indicators of program performance and being sufficiently flexible to respond to feedback.

- **Include features targeting supply-side actors in the program design**. Distributors influence contractors who influence customers. Program managers acknowledged that AC dealers play a pivotal role in promoting high-efficiency AC systems.

- **Understand local market conditions.** This understanding is 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.

- **Do not over-promise results.** Optimistic promises may attract more interest early on but they set the stage for disappointment later. As one respondent said, "Under promise and over deliver."

3.2 PROGRAM MANAGEMENT: PROJECT MANAGEMENT

The R2 Programs used a variety of program management structures, including a statewide administering agency, a statewide collaborative, adoption of common statewide administrative strategies based at individual utilities, and individual utility management without outside oversight or direction.

Distinctions between agency or collaborative administration and utility administration appear to yield few differences in overall success. However, a tight-knit administration team, whether including outside consultants or implementers or not, is necessary for program success.

For the Best Practices Study, the Program Management component includes the sub-components of project management, reporting and tracking, and quality and verification, which are discussed in this section. Program implementation, including its sub-components of marketing and outreach, participation process, and installation and delivery, is discussed more thoroughly in the Program Implementation section below. Exhibit R2-3 shows the different approaches for combined program management and implementation components for the R2 Programs.

Exhibit R2-3
R2 Program Management/Implementation Approaches

Program	Program Management/Implementation Approach
NY Keep Cool	Managed in-house by a state authority
NJ Clean Energy	Managed in-house by each utility with subcontractors for fulfillment and outreach
AC Distributor MT	Managed in-house with subcontractors for marketing, fulfillment and vendor outreach
2002 CA SW Single-Family AC	Managed in-house by each utility with support for application processing contracted to outside firms.
SRP Heat Pump	Administered primarily in-house
FPL Res AC	Implemented by in-house management

NYSERDA implemented NY Keep Cool as a state authority funded by a charge on the electricity transmitted and distributed by the State's investor-owned utilities. In addition to NYSERDA staff, there was one primary contractor for NY Keep Cool and two contractors for the related recycling effort. In earlier years the recycling contractors were subcontractors to the primary program contractor. It was subsequently found to be more cost-effective to have them contract directly with NYSERDA and then ensure good teamwork and communication among all parties.

The New Jersey Clean Energy Collaborative is a "partnership" of New Jersey State agencies, state energy utilities, energy businesses, and business and environmental organizations that develop and implement tools to help save energy and generate clean energy. Although the

developmental process takes place through the Collaborative, most program elements are currently administered by New Jersey's electric and gas utilities. This process is currently under review by the Board of Public Utilities. Incentive processing for NJ Clean Energy was handled in some areas by a contractor, while the Eastern Heating and Cooling Council (EHCC) provided contractor training. In addition to their participation in working group meetings as part of a design by consensus process, the seven New Jersey utilities provided inspection services and joint outreach, bill inserts, and tracking and reporting.

AC Distributor MT was managed in-house. Outside consultants were not used for project management or incentive processing, but did provide baseline and impact evaluation services.

California's IOUs collaborated on program design and policy-level implementation of CA SW Single-Family AC. In so doing, they sought to promote seamless program delivery to the marketplace. All the IOUs followed similar program management structures with internal program design and management staff supplemented with contractor support. Each utility had its own in-house procedures for managing administrative details.

SRP Heat Pump was managed primarily in-house. Independent AC contractors marketed the program to customers and performed the equipment installations. The program also relied on third party inspectors for quality control.

An FPL program manager led the FPL Res AC, working with "field" support from FPL representatives. Implementation activities were conducted primarily by in-house staff and include marketing, administration, and management. Successful implementation, however, also depended on AC contractors for program marketing at the customer level.

Best Practices

Program Management: Project Management
• Put the process plan, including program management, in writing. • Keep management teams small. • Include stakeholders in developing program implementation plans. • Capture and retain institutional memory in-house. • Spread implementation dollars among multiple "implementers," who may be distributors or contractors themselves.

- **<u>Put the process plan, including program management, in writing.</u>** A written plan is more likely to be a well thought-out plan and is easier to disseminate to the various affected stakeholders. This forces planners to more thoroughly think through implementation strategies and provides a mechanism for review by stakeholders. Thorough program implementation plans or policies and procedures manuals facilitate fair and consistent implementation and aid in design of management processes. Program materials must communicate program requirements, yet must be adaptable to

changing market conditions and unforeseen challenges throughout program implementation.

- **Keep management teams small.** This allows for close coordination, facilitates good communication, and increases the likelihood of reaching consensus.

- **Include multiple stakeholders in developing program implementation plans.** Broad stakeholder input bolsters the plan's credibility, produces a plan that reflects local market conditions, and addresses needs of stakeholders with divergent viewpoints.

- **Capture and retain institutional memory in-house.** Contract consultants provide valuable contributions, bringing outside knowledge and experience. Program managers should institute procedures to retain that knowledge and avoid sending newly gained experience away with the contract consultant when their contract ends.

- **Spread implementation dollars among multiple "implementers," who may be distributors or contractors themselves.** Multiple implementers help stimulate competition, provide a basis for accountability, and build in redundancy in the event any one contractor fails to perform.

3.3 PROGRAM MANAGEMENT: REPORTING AND TRACKING

All of the R2 Programs had some process for reporting and tracking the progress and impact of program activities. The characteristics of these systems varied depending upon reporting requirements and primary program focus.

Regardless of the system used, program managers reported relying on program tracking tools to monitor market response to program outreach, provide leading indicators of over- or under-achievement by market actors, and respond to regulatory reporting requirements. The tracking systems also provided a data source for *ex-post* analysis of costs and benefits and program evaluation. At least one program incorporated data tracking and analysis functionality to support market research on new and existing construction.

Program managers stressed the ability of their tracking systems to produce informative reports at frequent intervals or even in real time. This functionality was viewed as critical for taking early corrective action. Reports cited include program application submittal rate, visits to program Web sites, equipment distributor performance, variance between program goals and actual performance, and energy and demand impacts.

The best systems incorporated online interactivity for all program participants to eliminate duplication of data entry, provide data entry quality control, reduce paperwork, and manage random selection of installations for inspection and reporting inspection results. AC Distributor MT was particularly aggressive in using the Internet to manage interactions with distributors and contractors. An online database tool allowed participating contractors to submit applications electronically, report installations, calculate incentives, submit invoices, and track inspection and payment status.

Other key innovations included systems to verify contractor eligibility prior to authorizing incentives, algorithms to check equipment sizing calculations, dynamic links to the Air

Conditioning and Refrigeration Institute (ARI) database to verify Energy Efficiency Ratio (EER)/SEER according to matched components[6], and links to the customer information system (CIS) to populate records with correct customer name and address information.

To support the reporting and analysis functions described above, programs typically tracked a range of vendor, customer, and equipment data. The latter category generally covered both the new equipment being installed and the equipment being replaced and included parameters such as model numbers, manufacturer serial numbers, equipment type, costs, size, and energy efficiency levels.

Along with innovative and successful practices, program managers described a number of past or on-going challenges to good program tracking. In some cases, these challenges simply reflect the regulatory context, such as having multiple tracking systems distributed across multiple utilities and vendors. In other cases, the challenges reflected a constraint imposed by the broader corporate administrative structure, such as the need to monitor two separate systems that track program performance and financial payments independently. Program managers also described prior practices that had been abandoned or improved upon.

The detailed nature of resource acquisition tracking activity requires that robust and reliable computer systems are in place at the utility or the fulfillment houses where coupons are received, that databases are compatible and streamlined and that contractors can access and input data as needed.

All programs, but especially those with a market transformation focus, call for nimble tracking systems. Nimble systems provide information quickly and simply, and are important for adaptability – allowing for mid-course corrections and increasing the ability to anticipate consequences of program changes.

Exhibit R2-4 shows the different reporting and tracking methods used by the R2 Programs.

[6] At the time of writing, the most current version of the ARI database suitable for desktop installation included models through 2002. Verification of more recent AC models required contacting the manufacturer for specifications sheets, or searching the ARI's PrimeNet online database. The CEE also has a current ARI directory available for online search (www.cee1.org).

Exhibit R2-4
Reporting and Tracking Methods

Program	Reporting and Tracking Method/s
NY Keep Cool	Desktop database tracked store information, participant data, and other management metrics.
NJ Clean Energy	Each utility managed its own tracking and reported summary data to collaborative member GPU Energy for consolidation.
AC Distributor MT	Online database managed distributor applications, installation reporting, inspection records, distributor invoicing and payment processing.
2002 CA SW Single-Family AC	Tracking procedures varied by utility, generally using in-house systems. At least one system reported applications as submitted in real-time.
SRP Heat Pump	Desktop database tracked customer application, costs, old and new model details and verification of proper sizing.
FPL Res AC	Program managers received data on units sold, capacity, efficiency and goals.

While R2 Program tracking systems reflected the characteristics of the implementing organization and its reporting requirements, program staff from all organizations repeatedly mentioned the critical need for regular "pulse checks" regarding what is happening in the market and in one's own program. These can be weekly, monthly or quarterly.

Best Practices

Program Management: Reporting and Tracking
• Define and identify the key information needed to track and report early in the program development process. • Clearly articulate the data requirements to measure success. • Minimize duplicative data entry by linking databases to exchange information dynamically. • Conduct regular checks of tracking reports to assess program performance. • Develop accurate algorithms and assumptions on which to base estimates of savings. • Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions. • Automate routine functions such as monthly reports. • Build in rigorous quality control screens for data entry. • Carefully document the tracking system and provide manuals for all users.

- **Define and identify the key information needed to track and report early in the program development process.** Data needs that are clearly defined early on improve the ability to articulate data collection requirements in time to develop useful reporting and tracking systems in a cost-effective manner.

- **Clearly articulate the data requirements to measure success.** Clearly articulated data collection requirements enhance the prospects that those requirements will be met.

- **Minimize duplicative data entry by linking databases to exchange information dynamically.** This reduces costs and inconsistencies since information is entered in only one database – subsequent data is added to records. It also allows built-in error checking for everyone responsible for collecting or reporting information.

- **Conduct regular checks of tracking reports to assess program performance**. The tracking system must be monitored regularly to be useful. The tracking system is an ideal tool to incorporate variance-reporting features.

- **Develop accurate algorithms and assumptions on which to base estimates of savings.** This helps set reasonable expectations and avoid the temptation to oversell program benefits.

- **Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions.** This enhances the quality and cost-effectiveness of information management, helps minimize duplicative data entry and storage, and automates many routine quality-control steps.

- **Automate routine functions such as monthly reports.** This builds in quality control checks and frees up staff time for more strategically important tasks.

- **Build in rigorous quality control screens for data entry.** This minimizes the extent of subsequent data cleaning and enhances the accuracy and credibility of reported results.

- **Carefully document the tracking system and provide manuals for all users.** This helps mitigate problems stemming from staff turnover, especially when the system must serve a variety of users with varying computer skill levels.

3.4 PROGRAM MANAGEMENT: QUALITY CONTROL AND VERIFICATION

Quality Control (QC) and measure verification are important components of AC efficiency programs. Correct calculation of program impacts is subject to proper reporting of equipment brand and model numbers, the ability to determine whether split system components are properly matched, tracking sizing practices, and the ensuring of proper installation. Serial number tracking is also important to some implementers to ensure that more than one applicant does not apply for an incentive on the same unit. Physical inspections help ensure proper measure installation by contractors.

On-site inspections, telephone interviews, and customer response post cards were the principal means of providing QC and verification of installation for the R2 Programs.[7] On-site inspections were conducted on a randomly drawn sample, typically five to ten percent of all projects. QC efforts generally focused on equipment eligibility, consistency with reported results, and installation quality. Several R2 Programs included unique features worth highlighting:

NY Keep Cool used a barcode applied to old room AC and through-the-wall units turned in for recycling. A corresponding barcode tag was applied to incentive applications. Verification of valid addresses was made using US Postal service data to check for the correct utility and borough. Scanning technology gave NY Keep Cool electronic payment capability. It also allowed comparison of truck driver and retailer counts to verify reports.

NJ Clean Energy verified measures using field inspectors to check ten percent of installed electric air-to-air systems and 100 percent of geothermal systems. The program's verification was moving toward a North American Technician Excellence (NATE) certification requirement. The NATE program provides installation training, education and testing of AC contractors.

AC Distributor MT verified equipment installation via a combination of on-site inspections, telephone surveys, and mail-back response cards. In order to make the mail survey approach work, Oncor added a small incentive for customer mail survey respondents. The survey cards were also designed to provide a detailed description, with photograph, of exact placement of model and serial numbers for each equipment manufacturer.

For CA SW Single-Family AC, the California utilities performed on-site installation verification of five percent of contractor-installed measures. They also inspected 100 percent of customer-installed insulation (the only qualifying customer-installed measure). Problematic or suspicious cases were also flagged for inspection, for example, if equipment eligibility was in question or the customer exceeded the reasonableness limit on the quantity of measures installed (typically for measures like dishwashers and whole house fans). Finally, an independent evaluator added an additional layer of QC via random inspection of paper applications, a match-up to tracking system entries, and/or verification that rebated measures qualified under the program. The tracking system lacked quantified data on verification failures.

[7] It is important to note that the R2 Programs did not include any Check Me!-type program models. Best Practices Study Volume NR2 on non-residential AC provides additional insights into promising quality control strategies that may apply to the residential sector.

Best Practices

Program Management: Quality Control and Verification
• Develop inspection and verification procedures during the program design phase. • Consider administrative cost in designing the verification strategy. • Provide quick and timely feedback to applicants. • Ensure that inspectors have adequate training in identifying and explaining reasons for failure. • Use the inspection and verification function as a training tool for the market, especially in market transformation programs. • Establish a streamlined inspection scheduling process. • Build in statistical features to the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work.

- **Develop inspection and verification procedures during the program design phase.** This helps ensure that participants plan to provide required data. Although this is common practice, the following aspects of verification procedures need to be included:
  - Characteristics that affect equipment nameplate efficiency (model numbers to verify matched components);
  - Aspects of proper installation that assure peak performance (proper sizing, system commissioning, proper charging);
  - Characteristics required to meet market transformation objectives (contractor sales material, proportion of efficient products relative to contractor's, dealer's or distributor's total sales volume); and
  - Disposition of replaced equipment, particularly for programs addressing room unit air conditioners (certification or verification of removal from operation and de-manufacture or disposal.

- **Consider administrative cost in designing the verification strategy.** Evaluate the incremental cost of additional rigor in verification against the magnitude of risk. High levels of confidence and precision are costly, and inappropriate for low-risk programs (and visa versa). Factoring in all related costs, including often overlooked administrative costs, helps ensure maximum cost-effectiveness for verification activities. Technology innovations, such as barcodes on recycled units, can streamline verification. Enlisting customers in recording/reporting verification results can also reduce costs.

- **Provide quick and timely feedback to applicants.** Long delays between installation and inspection feedback create lost opportunities and potential ill will.

- **Ensure that inspectors have adequate training in identifying and explaining reasons for failure.** Program credibility is dependent upon inspectors accurately reporting problems and solutions.

- **Use the inspection and verification function as a training tool for the market, especially in market transformation programs.** The verification process in market transformation programs is less about validating or justifying individual site incentive payments and more about successfully moving the market. Spillover benefits of such programs increase through effective training facilitated by the inspection and verification process.

- **Establish a streamlined inspection scheduling process.** This avoids imposing hidden costs on program participants in the form of project delays. This can more easily be handled through the program management database that allows considerations such as geography or grouping of measures requiring specialized inspectors.

- **Build in statistical features to the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work.** Cost control and program success are highly dependent upon limiting inspection requirements while ensuring that inspections are targeted where needed.

3.5 PROGRAM IMPLEMENTATION: PARTICIPATION PROCESS

The participation process varied among R2 Programs according to the target audience, although a common thread was the significant role of supply-side players in promoting and implementing the programs. Useful information for program participation process best practices can be discerned by looking at both the program participation strategy as well as participation mechanisms.

Role of supply-side market actors. Several programs targeting central split system AC units relied heavily on supply-side market actors to market program benefits and deliver services. Contractor training was the core of NJ Clean Energy. After training, contractors marketed their services to consumers. The program did not market directly to consumers as its predecessors had. Training was provided through a turnkey training services contract with the EHCC. FPL Res AC also relied heavily on contractors for customer-side program delivery. The utility established a carefully crafted set of standards for contractor compliance. Despite the perceived burden of the periodic training requirement, FPL's participation process resulted in 159 percent goal attainment in 2002. FPL has also been decreasing the incentive level over time, apparently without loss in contractor or customer participation. Even among programs that target end-users, the general consensus is that contractors and distributors play key roles in the equipment specification process, particularly in replace-on-burnout situations for which the first priority is to install a working system as quickly as possible.

Role of end-users. Programs reflected two different philosophies regarding the role of end-users. AC Distributor MT and NJ Clean Energy focused training and incentives exclusively on supply-side market actors and then left it to them to deliver services to their clients. On the other hand, programs such as SRP Heat Pump targeted incentives to the end-users as a strategy for stimulating market demand and raising the program's profile within the community.

Regardless of the philosophy, it is important to link incentive receipt and documentation responsibility. For example, the customer (who received the incentive) was ultimately responsible for completing the application and obtaining any required documentation or other assistance from the contractor for SRP Heat Pump.

Documentation requirements. There is general agreement that requirements for Manual J calculations to demonstrate proper sizing improve overall energy efficiency of equipment installations. However, they also add substantially to the contractor's reporting requirements, which discourages participation. AC Distributor MT did not require Manual J calculations documentation. Instead, it decoupled equipment size and incentive amount as a means of avoiding rewarding oversized units. Requiring documentation proved more effective as part of a long-term market transformation strategy that emphasizes contractor training.

Among R2 Programs there was increased use of the Internet to minimize documentation burdens and automate administrative functions. Utilities generally offered program applications online and Oncor relied on an Internet-based database to handle a substantial portion of the AC Distributor MT application process. However, no utility had developed a purely paperless application process.

Documentation requirements were rather different for equipment that did not present the installation challenges of central AC. For CA SW Single-Family AC, programmable thermostats qualified for an instant rebate from the retailer who invoiced the IOU for reimbursement. NY Keep Cool emphasized the de-manufacture of old RACs, based on studies indicating that rebates for high-efficiency rebates encouraged consumers to increase total cooling capacity by moving the inefficient unit to another room. In order to receive a program bounty, participants had to both purchase a qualifying unit and turn in a working old unit for de-manufacture. Old units could have been turned in at participating retailers, or at other designated turn-in locations. After testing that the turned-in unit works, the turn-in facility provided a barcode tag to the customer. The tag was returned with the new unit receipt and application for bounty.

Equipment eligibility. There are at least two schools of thought on this issue. Some programs, such as CA SW Single-Family AC, limited equipment eligibility to ENERGY STAR-labeled units. The rationale was to rely on a well-recognized brand to clearly communicate what qualified and why. Other programs, such as AC Distributor MT, offered incentives for all equipment over a minimum performance standard, regardless of labeling. This strategy maximized the list of available equipment. Regardless of the strategy chosen, SRP found that it was important to ensure that the market was capable of meeting the demand for any equipment covered under the program.

Exhibit R2-5 displays the different tactics used by the R2 Programs.

Exhibit R2-5
Residential AC – Program Tactics

TACTIC	NY Keep Cool	NJ Clean Energy	AC Distributor MT	2002 CA SW Single-Family AC	SRP Heat Pump	FPL Res AC
Online Applications			✓	✓		
Mandatory Proper Sizing		✓		✓	✓	✓
Contractor/Distributor Training	✓	✓	✓		✓	✓
Cooperative Marketing	✓	✓	✓	✓	✓	
Regional Coordination	✓	✓	✓	✓		
Retailer/Contractor Support and Upstream Buy-downs	✓	✓	✓			✓

The lessons learned from these various approaches clearly demonstrate that no one approach has proved to be the single most effective one. Exhibit R2-6 displays insights and lessons learned by R2 Program staff.

Exhibit R2-6
Residential AC Programs Lessons Learned – Participation

Participation Tactic	Tactic Description	Lessons learned
Online Applications	Eligible customers or vendors can apply online for rebates or funds. Other features include progress and installation reporting.	Internet application processing facilitates participation and program management.
Mandatory Proper Sizing and Installation Practices	Equipment that is matched to the load and has been properly commissioned helps ensure maximum economic benefit.	System efficiency and program cost-effectiveness is improved with proper equipment sizing. Verification of proper sizing and installation (including refrigerant charging) is especially important for programs with tonnage-based incentives.
Contractor/Distributor Training	Training on sales strategies, proper sizing, and installation practices. This helps give upstream market actors the tools needed to promote and produce efficient installations.	Training not only helps increase installation efficacy, but also improves contractors' selling skills to help customers assess the benefits of increased HVAC efficiency.
Cooperative Marketing	Multiple sources giving the same message – generally meaning that utility, contractor, distributor, and manufacturer advertising content are in concert.	Leverage dollars whenever possible. Joint or cooperative advertising reduces the administrating entity's marketing costs. Common messages from multiple sources help increase participation.
Regional Coordination	Utilities within the same region have overlapping media and contractors. Coordinating program design and administration helps make maximum use of administrative overhead.	Coordination among utilities operating in a specific region simplifies contractor participation. Common procedures, guidelines, inspection, and invoicing procedures reduce confusion and errors.
Retailer or Contractor Support/Upstream Buy-downs	This form of incentive is intended to help contractors make efficient equipment price competitive with standard equipment; or it may simply act as a tool to encourage contractor support.	Can exacerbate due diligence issues with regulators – reporting requirements will dictate how simple a buy-down strategy can be. Investment can reduce the price point and have a profound impact in the marketplace. This strategy is more difficult if regulators want to see incentives passed on to the end-user.

Incentive Approaches

Utilities took a variety of approaches to setting incentive levels for the R2 Programs, including those of an incremental cost offset, an "avoided cost cap," market penetration optimization, and "revenue neutral" (meaning that combined avoided costs, revenue additions or reductions, and avoided costs net out).

NJ Clean Energy incentives were based on the incremental cost theory. The program aimed to cover 50-60 percent of incremental costs, typically producing a five-seven year payback.

Incentives for lower level efficient units were decreased to encourage installers to move to units exceeding 14 SEER.

AC Distributor MT incentives were capped at 50 percent of a proxy avoided cost value for projects at residential sites. Within that cap, Oncor attempted to optimize incentives according to market response. Although initially the program's incentives varied based on SEER and tonnage, they were later based solely on SEER in order to discourage over-sizing.

CA SW Single-Family AC offered prescriptive customer rebates that varied as the market responded to changes such as new technologies, new standards and changing customer awareness. The measure incremental cost was also taken into account when rebate levels were set.

NY Keep Cool was market-based. The bounty declined as the impact of previous incentives and marketing messages had an effect in the market. NYSERDA has already decreased the bounty amount from $75 to $35 per room unit and expects to drop it entirely in upcoming program years.

SRP Heat Pump offered $250 per unit (not per ton).

Best Practices

Program Implementation: Participation Process
• Review and understand product availability before establishing product eligibility. • Offer personal assistance in preparing and submitting program applications, or provide thorough application procedures manuals or online help tools. • Use the Internet to facilitate program participation, include procedures to report installation details. • Provide contractors with easy-to-use load software for running the Manual J calculations if these calculations are required. • Avoid being the middleman. • Keep participation simple. • Provide AC contractors training on proper installation practices. • Develop a technical and procedural manual for participating market actors. • Use incentives to provide the impetus that prompts upstream market actors (contractors, distributors, and manufacturers) to promote high-efficiency air conditioners and customers to consider the high-efficiency alternative.

- **Review and understand product availability before establishing product eligibility**. Constant review ensures that program standards move the market forward without creating demand that significantly exceeds supply (which could result in consumer backlash).

- **Offer personal assistance in preparing and submitting program applications, or provide thorough application procedures manuals or online help tools.** The application process sets the tone for program implementation. User-friendly procedures help generate immediate participant buy-in.

- **Use the Internet to facilitate program participation, include procedures to report installation details**. This minimizes the administrative burden associated with program participation.

- **Provide contractors with easy-to-use load software for running Manual J calculations if these calculations are required.** While proper sizing is integral to achieving optimum efficiency, mandatory load calculation and reporting requirements tend to stifle participation. Tools to facilitate load calculation requirements help eliminate a potential deterrent to participation.

- **Avoid being the middleman**. The customer should have sole responsibility for contracting with the installer and ensuring that all calculations and paperwork are properly completed and submitted. Properly administered, this reduces the number of errors in initial filings and the associated administrative costs.

- **Keep participation simple.** Simplicity is important whether the target is retailers, manufacturers or consumers. Administrators should examine application procedures, reporting, invoicing, inspections and payment procedures to streamline processes. The Internet appears to be a key feature of simplifying program processes.

- **Provide AC contractors training on proper installation practices.** Full system efficiency at manufacturer-rated levels are only realized with accurate sizing, properly matched coils, correct system charging, and thorough commissioning to ensure proper operation. AC contractor training develops these installation skills as well as selling skills, which helps ensure that contractors and utilities deliver the same messages.

- **Develop a technical and procedural manual for participating market actors.** This makes participation straightforward, routine, and predictable. It reduces the degree of "hand-holding" program staff must provide.

- **Use incentives to provide the impetus that prompts upstream market actors (contractors, distributors, and manufacturers) to promote high-efficiency air conditioners and customers to consider the high-efficiency alternative**. This helps 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. Directing incentives to upstream market actors can influence contractor attitudes**.** Since consumers rely heavily on contractor recommendations, programs that influence contractor attitudes will effectively spill over to consumer behavior.

3.6 PROGRAM IMPLEMENTATION: MARKETING AND OUTREACH

The R2 Programs engaged in a variety of marketing and outreach efforts aimed at encouraging program participation. Surprisingly, only one relied extensively on the ENERGY STAR logo

and partnership approach, while others referred to the ENERGY STAR brand as a tool to help gain immediate customer confidence. Most programs utilized traditional communication approaches such as utility bill inserts, newsletters, print and broadcast advertising, and trade shows. The Internet was also a common method of reaching customers.

NY Keep Cool worked with another NYSERDA program that assisted with advertising, marketing and outreach efforts. This sister program, the Keep Cool Campaign, provided advertising for NY Keep Cool and had its own program objectives as well, including load-shifting.[8] Much of the retailer-related work, including training and the development of point of purchase (POP) materials, was done through the ENERGY STAR Products Program. All NY Keep Cool participating retailers were required to become ENERGY STAR Products Program retailers. Many of them were recruited from among those participating in the Keep Cool Campaign program. Additional retailers were recruited from firms selling only RACs.

To promote NY Keep Cool, NYSERDA produced television and radio advertising, newspaper advertising, bill inserts, brochures, and trade association shows and exhibits, which included a sweepstakes element. They also worked with manufacturers, provided POP materials, and engaged in cooperative advertising with retailers. The greatest success was achieved from the television advertising done with Governor Pataki. NYSERDA also felt their Web site effort was quite innovative (using banner advertising with click-throughs on a variety of New York-related Web sites, e.g., those featuring weather reports for the area). NYSERDA measured increases in program awareness from 25 percent in May to 45 percent in September, a relative increase of 80 percent. Over the same period, ENERGY STAR label awareness rose from 56 percent to 72 percent, a relative increase of 29 percent.

NJ Clean Energy reached customers in much the same way, using direct mail, newspaper ads, commercial telephone directory advertisements, bill inserts and brochures. However, since customers tended to rely on contractors for advice, consumer ads did not prove very effective. Rather, the most effective advertising resources were directed to the industry and trade allies. Other supply-side outreach involved program meetings with 15 manufacturer, distributor and contractor representatives, and the *Contractor Connections* newsletter, which was published and distributed to 5,000 trade people quarterly. Builders and contractors were also reached through seminars and workshops. EHCC provided site visit services, delivering brochures and rebate forms to distributors. EHCC also produced substantial word-of-mouth leads.

The objective of the program's supply-side outreach strategy was to educate contractors in order to use them to market the program. Another goal was to improve contractors' technical skills, awareness, attitudes and knowledge of energy efficiency technologies and practices. There is considerable evidence that this strategy was effective for NJ Clean Energy and its predecessor programs. The number of properly sized installations increased. Studies indicate a reduction in over-sizing practices from 60 percent in 1997 to less than 40 percent in 1999. New Jersey ARI shipment data shows that high-efficiency product market share has increased since program inception. Quality controllers report observing improved charging practices in the field over the same timeframe.

[8] This program is covered in the Best Practices Study Volume O1 on crosscutting advertising.

Oncor relied primarily on face-to-face meetings between program staff and participating distributors to promote the AC Distributor MT. Oncor staff also attended distributor dealer meetings to explain how eligibility was determined and how to handle reporting. While regular contact helped promote the program, that contact had to be purposeful to avoid losing distributor interest.

CA SW Single-Family AC had an outreach objective of making customers aware of program rebates and ensuring reach into the HTR market. Consumer awareness was the key to program success, especially in the HTR sector. *Ex-post* evaluation surveys conducted in 2003 show that overall awareness among Californians of utility programs for energy efficiency improvements is high. The 2002 Statewide Residential Retrofit Single-family Home Energy Efficiency Rebate Program Evaluation reported that 41 percent had heard of rebates and over 50 percent were aware of ENERGY STAR.

The California IOUs used bill inserts to alert customers to energy efficiency options and direct them to their Web sites, which supported the high-efficiency message. Web site use has increased from about 35 percent in 2002 to more than 45 percent in 2003. PG&E also contacted about 100,000 residential customers who experienced above average but not high-use electric bills. PG&E has found its audience to be weary of unsolicited commercial contact techniques like spam and telemarketing. The utilities developed marketing messages for CA SW Single-Family AC by reviewing trade ally sector messages to determine missing elements. Those elements were incorporated into the program messages.

While using multiple marketing methods proved successful for them, the California utilities found that retailers played a significant role in making customers aware of program rebates. In 2002, one of every two surveyed participants received their rebate application from a retail store.

Salt River Project marketed SRP Heat Pump primarily to AC contractors through direct mail and trade publications. While reaching customers was not an issue, contacting contractors proved challenging. SRP mailed out several different direct mail pieces that included full program participation packets and applications. A pre-approved drop-in advertisement was developed for use by contractors. SRP also promoted the program to homeowners in bill inserts and newsletters.

In the air conditioning systems market, upstream market actors have much greater influence on consumer choices than utilities, regardless of advertising or promotional efforts. Frequently, consumers purchase air conditioners only when they need immediate replacement of a broken unit, which can blind them to any considerations other than speed of installation. Since this tends to occur during peak use season (i.e., summertime) the weather works against attempts to match program and efficiency messages with related needs. This is particularly true in hot and humid climates. The best programs rely on contractors to bridge the gap and take the utility's message to consumers at this critical point of decision opportunity.

Best Practices

Program Implementation: Marketing & Outreach
• Use the ENERGY STAR logo to instill consumer confidence. • Communicate with customers through multiple media. • Cooperate with retailers and contractors to promote the program. • Know your target consumer demographic and tailor your messages, incentive structures and promotional strategies to the audience.

- **Use the ENERGY STAR logo to instill consumer confidence.** Many consumers now recognize the logo and understand its message of assuring the efficiency of labeled products.

- **Communicate with customers through multiple media.** Combine point-of-sale marketing via showrooms and brochures in contractors' trucks with direct marketing to consumers via radio, print and television. Although consumers rely on contractors as their chief source of information, a variety of mutually reinforcing messages via different information sources will be more effective. Customer outreach is also more important for AC retrofit programs and non-AC elements of whole-house programs since the consumer may initiate action independently of the operating condition of the air conditioning system.

- **Cooperate with retailers and contractors to promote the program.** Consumers rely on AC contractors as their chief source of information about air conditioning systems. Using them for program promotion is critical. AC contractors can be an effective sales force when the program is designed to align their self-interest with program goals.

- **Know your target consumer demographic and tailor your messages, incentive structures and promotional strategies to the audience.** Customer demographics vary widely by region and one-size does not fit all as a marketing strategy. Consumers increasingly use the Internet to research products and concepts prior to purchase.

3.7 PROGRAM EVALUATION

Program evaluation activities varied across the R2 Programs. End-user and supply-side surveys were used to evaluate program process issues. Engineering calculations were applied to survey and database records to determine program impacts. Evaluation results were used to modify program designs and to better report program impacts to managers and regulatory authorities.

The evaluation goal for NY Keep Cool was to provide information for internal use to make program improvements. It was supported by pre- and post-surveys that indicated a significant rise in program awareness, as well as recognition of the ENERGY STAR label. Engineering activities revolved around functionality testing to ensure that impacts were indeed based on

replacement of working units. Surveys and functionality testing were supplemented with focus groups of retailers, consumers and building owners.

In 2002, an independent evaluator conducted a verification study, impact evaluation (pool pumps, thermostats), process evaluation, and market assessment for PG&E's whole-house program.

Salt River Project conducted contractor interviews, postcard surveys, training attendee surveys, and field inspections for SRP Heat Pump. Data was collected as the program was implemented, combined with tracking system information, and then analyzed for both process and impact estimates.

Florida Power and Light regularly completes detailed impact, market and process evaluations to inform program effectiveness and cost-effectiveness, with consideration of program adjustments in response to evaluation findings. FPL's incentive adjustments have always been based on evaluation studies and other findings. Market and regulatory shifts have been used to move the minimum program qualifying efficiency level, as will be the case in 2006 when the baseline shifts from 12 to 13 SEER. Evaluations have also been used to retrospectively assess the effectiveness of program implementation changes. For example, in June 2000, multi-speed and variable-speed equipment became eligible for the utility's AC program, so a new 15 SEER metering sample was deployed to examine the effects of this program change on expected program impacts. Evaluations related to FLP Res AC included detailed program impact models and AC saturation by segment, vintage, capacity and efficiency.

The New Jersey Clean Energy Collaborative conducted a baseline study in 2001 to obtain insight into installation quality and energy efficiency. Similarly, Oncor conducted an initial study to establish baseline data regarding system efficiency and installation practices. The baseline study was followed with an additional evaluation of AC Distributor MT to evaluate the differences in sales and installation practices between participating and non-participating dealers. This study provided insights into market effects from which engineering calculations were used to estimate impacts.

The Collaborative's evaluation effort has contributed significantly to current program design, and has produced several evaluation indicators that are used determine program effectiveness and drive design:

- Market shares for high-efficiency (e.g., SEER 13) equipment;
- Incremental cost of high-efficiency equipment;
- Percentage of jobs receiving quality installations;
- Number of contractors participating who have received "quality contractor" certification;
- Impact of quality contractor certification on sales volume for participating contractors;
- Consumer awareness of the elements and importance of quality installations; and
- Number of homes receiving retrofit duct sealing and repair services.

Feedback from participants led Oncor to petition the PUCT for changes in the AC program template to reduce the administrative burden for participants and broaden participation. Additional evaluation work has been completed to analyze the differences in sales and installation practices between participating and non-participating dealers. This work has shown that AC Distributor MT has raised the level of installed efficiency for a larger proportion of units than Oncor previously estimated. It showed that the emphasis on promoting efficiency paid off for contractors who might not have been able to reach program minimums, but were still able to "sell up" based on efficiency (Oncor Electric Delivery Company 2004). Oncor has incorporated the savings produced by the incremental efficiency in its annual report to the PUCT.

Best Practices

Program Evaluation
• Regularly complete and utilize program evaluation to support program rationale and program design. • Develop evaluation metrics that are in line with program goals. • Clearly explain to participants early in the process any role they may be asked to play in the evaluation. • View evaluation results in the context of the overall market. • Periodically review and update market-level information about AC distributor and contractor installation practices and consumer awareness of benefits associated with high efficiency, matched systems, proper sizing and proper installation practices. • Periodically review and update algorithms for calculating project savings.

- **Regularly complete and utilize program evaluation to support program rationale and program design.** Changing technologies, regulatory requirements and market conditions affect the suitability of any program design. Regular process and impact evaluation ensures that program design matches actual market conditions and produces the savings management and regulators expect.

- **Develop evaluation metrics that are in line with program goals**. The only way to assess program progress toward achieving pre-determined goals is to establish metrics that measure that progress.

- **Clearly explain to participants early in the process any role they may be asked to play in the evaluation.** This particularly helps customers understand the reason for follow-up calls, surveys or postcards.

- **View evaluation results in the context of the overall market.** Market changes, rather than program failures, may be responsible for unexpected results. Be sure recommendations reflect new market conditions as well as identified weaknesses in program design.

- **Periodically review and update market-level information about AC distributor and contractor installation practices and consumer awareness of benefits associated with high efficiency, matched systems, proper sizing and proper installation practices**. Program design must reflect current market conditions. Program resources should not be expended to promote technologies and practices that are already industry standards.

- **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, customer behavior and available technologies change.

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.[9]

- **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.

[9] 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.

This section presents program cost metrics obtained from the R2 Programs. Information on the Total Resource Cost (TRC) test, the associated discount rate and the average measure life was not generally available, nor was Utility/Program Administrator Cost test information. Exhibit R2-7 displays cost-effectiveness data, including program, incentive, and non-incentive dollars spent per kW, which offer 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 total program cost shown per MWh saved is an indicator related to the Utility/Program Administrator 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 kWh, which offer an indication of the cost to market and administer. Incentive dollars per kWh shows the overall average incentive amount per unit of estimated first-year impact.

The information in this exhibit reflects the variety of assumptions used by program implementers in an effort to determine actual energy savings resulting from program activities. Variations in assumptions can lead to different savings estimates for programs that, in fact, might be quite similar if a consistent set of assumptions were used.

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 applications, net-to-gross and other factors. The benefit side of cost-effectiveness is based on avoided cost, which differs substantially across service territories. Measure mix also effects cost-effectiveness – some measures simply have lower costs per kWh saved.

Exhibit R2-7
Residential AC Program Effects

Element	NY Keep Cool	NJ Clean Energy	AC Distributor MT	2002 CA SW Single-Family AC[1]	SRP Heat Pump	FPL Res AC
Period Reviewed	2002	2002	2003	2002	May – Oct 2001	2002
Net to Gross Ratio	NAV[2]	NAV	NAV	0.8	NAV	NAV
Free Ridership Rate	NAV	NAV	NAV	NAV	NAV	NAV
Total Resource Cost/Societal Test	NAV	NAV	NAV	NAV	NAV	NAV
Average measure life (years)	NAV	NAV	>10	NAV	NAV	NAV
Average measure life (hours)	NAV	NAV	NAV	NAV	NAV	NAV
Net MWh (Annual)	NAV	NAV	NAV	8,399	NAV	NAV
Gross MWh	27,208	NAV	13,478	10,499	NAV	78,957
Net kW (Annual)	NAV	NAV	NAV	NAV	NAV	NAV
Gross kW (Annual)	44,813	NAV	10,800	NAV		37,360
Real Discount Rate	NAV	NAV	10%[3]	NAV	NAV	NAV
Budget Per Impact						
Program Expenditures	NAV	$18,490,000	$2,502,541	NAV	NAV	$18,048,000
Incentive Expenditures	$11,572,350	NAV	$2,302,890	$4,912,891	NAV	$16,859,000
Program $/first-year kWh saved	NAV	NAV	$0.186	NAV	NAV	$0.229
Incentive Dollars per kWh	$0.425	NAV	$0.171	$0.584	NAV	$0.214
Non-Incentive Dollars per kWh	NAV	NAV	$0.015	NAV	NAV	$0.015
Program $/first-year kW saved	NAV	NAV	$232	NAV	NAV	$483
Incentive Dollars per kW	$258	NAV	$213	NAV	NAV	$451
Non-Incentive Dollars Spent per kW	NAV	NAV	$18.49	NAV	NAV	$32

[1] Program outcomes for the full program, including non-HVAC measures, are reported in Best Practices Study Volume R4: Residential Single-family Comprehensive Best Practices Report. Figures reported here are for the following measures: Central AC, Heat Pump, Room AC, Evaporative Coolers, and Whole House Fans.

[2] NYSERDA estimates "spillover effects" at the rate of 1.1 per bounty paid.

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, 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.

Much of the variation in program costs per first-year kWh saved is likely a function of incentive levels and measure mix. If TRC costs (i.e., program costs plus participant costs) and per unit measure costs and savings were available (and, thus, could be normalized), the variation across programs would most likely be significantly reduced. Cost-effectiveness must be examined in light of the quality, consistency, and reliability of the data and assumptions that drive these outcome metrics (e.g., measure cost, measure life, incremental cost and savings per measure). In addition, program and policy objectives (in particular, those pertaining to size and types of customers as well as measure mix) and market penetration levels must be taken into account when comparing cost-effectiveness indicators.

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APPENDIX R2A – BRIEF INTRODUCTION TO THE NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

INTRODUCTION

This report presents results of a comparative analysis of residential air conditioning 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

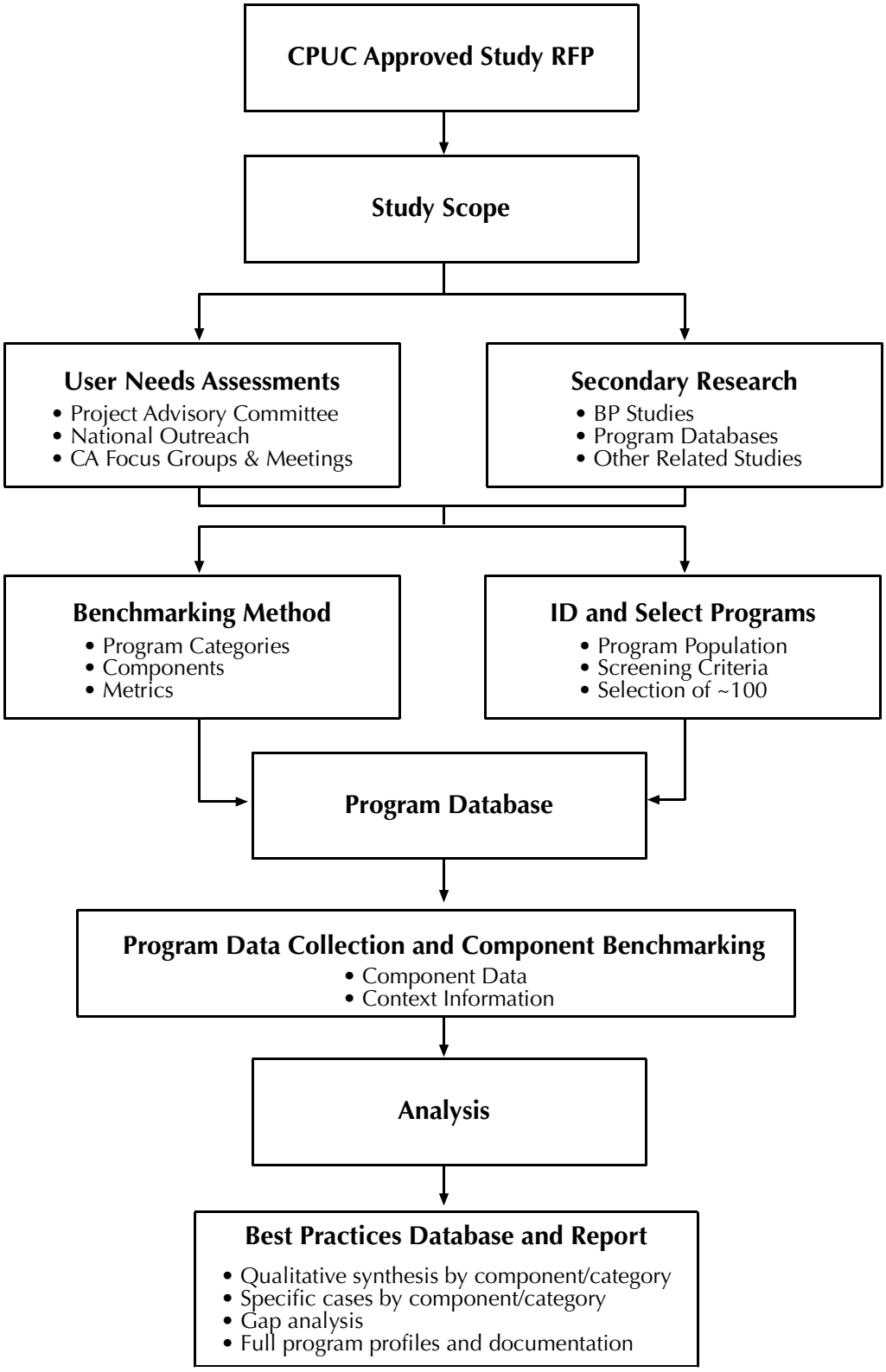
The overall goal of the Best Practices Study is to develop and implement a method to identify and communicate excellent energy efficiency program practices nationwide in order to enhance the design of such programs in California. In particular, program implementers supported through public goods funds 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

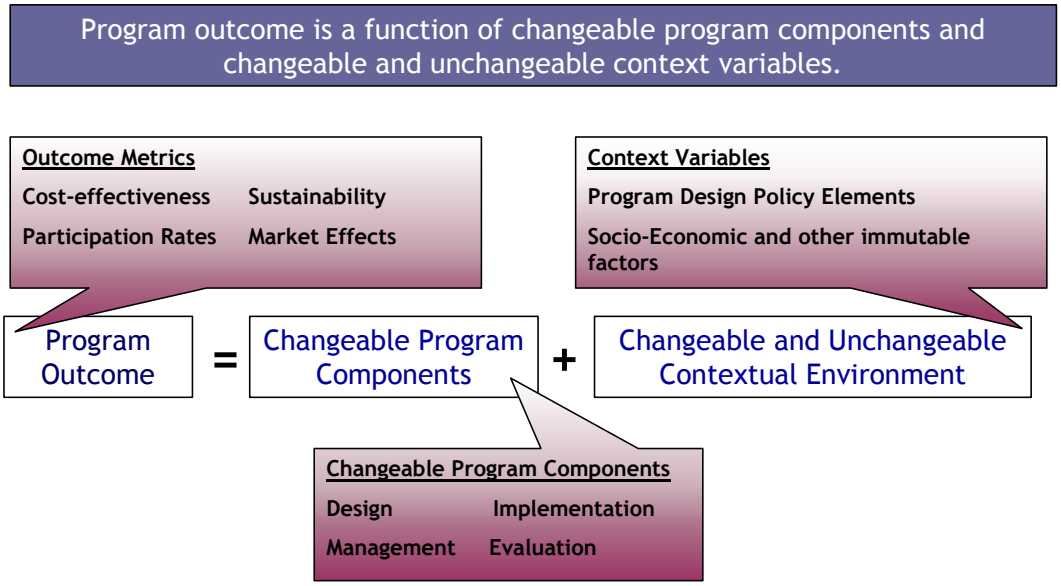
Key aspects of the Best Practices Study include a user needs assessment, secondary research, development of the benchmarking methods, identification and selection of programs to benchmark, development of the program database, data collection and program benchmarking, analysis, and preparation of the 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 R2-8 below.

Exhibit R2-8
Overview of Energy Efficiency Best Practices Study



As shown below in Exhibit R2-9, 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 R2-9
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 R2-10 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., R2 Programs = Residential Heating & Cooling Programs reviewed for the Best Practices Study).

Exhibit R2-10
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.