QUANTUM CONSULTING

NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

VOLUME NR2 – NON-RESIDENTIAL HVAC BEST PRACTICES REPORT

Submitted to

California Best Practices Project Advisory Committee
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ES. EXECUTIVE SUMMARY FOR NON-RESIDENTIAL HVAC PROGRAM AREA (NR2)

ES.1 INTRODUCTION

This volume presents results of a comparative analysis of Non-residential heating, ventilation, and air conditioning (HVAC) programs included in the National Energy Efficiency Best Practices Study. The overall study objectives, scope, and methodology are briefly outlined in Appendix NR2A of this report. More details on methods and cross-program findings are provided in separate report volumes.

The Best Practices research team reviewed six Non-residential HVAC programs for this report. The programs reviewed are presented in the body of this report, a discussion of the program selection process is provided in Appendix NR2B.

ES.2 KEY CATEGORY THEMES

Each of the programs reviewed in this category targeted commercial and industrial (C&I) HVAC systems as either a core or an essential element of their program design. The programs reviewed for this study took varied approaches to reaching the C&I HVAC market. There was substantial variation in targeted customers, equipment, and approaches to efficiency improvement, with some utilities focusing on upgrading large chillers, some concentrating on direct expansion (DX) rooftop equipment upgrades, and others attending to installation and maintenance practices to effect higher efficiency operation. Despite the variation in approach, three key themes emerged from this study:

Enlist trade ally support in program delivery. Each program relied upon upstream market actors to play a central role in program marketing and delivery, despite variations in customer or equipment attributes. While end-use customers are targeted, each program's success is built on recognizing the central role played by equipment vendors.

Utilize targeted incentives. Incentives play an important role in ensuring compliance with program standards and encouraging trade allies to adopt marketing, sales, installation, and commissioning strategies that increase customers' adoption of recommended practices.

Ensure proper installation, commissioning, and installation. Confirmation that installations comply with program installation standards and commissioning guidelines is recognized as an integral component of successful commercial HVAC programs.

ES.3 BEST PRACTICES SUMMARIES

Best practices are identified in this study for each of the major program components used to organize our data collection and analysis. These program components are Program Design, Program Management, Program Implementation, and Program Evaluation. Best practices were developed by analyzing information across programs developed from detailed interviews of program managers and thorough review of relevant secondary sources such as program filings and evaluations. In Exhibit NR2-E1 we present the list of best practices developed from our

analysis of Non-residential HVAC programs. In Exhibit NR2-E2 we provide 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 HVAC element of California's Express Efficiency Program is in progress and will be published when complete in a separate document.

Exhibit NR2-E1
NR2 Programs: Non-residential HVAC Programs Reviewed For NR2 Study

Program Name	Implementer/s	Abbreviation for NR2 Report	Current Status
2002 New England Efficiency Partnership's (NEEP) Cool Choice Program	Connecticut: Connecticut Light and Power Co., United Illuminating Massachusetts: Cape Light Compact, Massachusetts Electric Co., Nantucket Electric Co., NSTAR Electric, Unitil/Fitchburg Gas & Electric Light Co., Western Massachusetts Electric Co. New Jersey: Conectiv Power Delivery, Jersey Central Power & Light, Public Service Electric & Gas Rhode Island: Narragansett Electric Co. Vermont: Burlington Electric, Efficiency Vermont	2002 NEEP Cool Choice	Active with changes
2001Avista Rooftop HVAC Maintenance Program	Avista Utilities	2001 Avista Rooftop HVAC Maintenance	Concluded in 2001
2002 California Express Efficiency HVAC Component	Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, Southern California Gas	2002 CA Express Efficiency	Active with changes
Los Angeles Department of Water and Power Chiller Efficiency	Los Angeles Department of Water and Power	LA Chiller Efficiency	Active with changes
2002 Florida Power and Light Commercial/Industrial HVAC Program	Florida Power and Light	2002 FPL C/I HVAC	Active with changes
2001 Glendale Water and Power CheckMe!	Glendale Water and Power	2001 GWP CheckMe!	AC Tune-up and Duct Testing are still offered.

Exhibit NR2-E2
Summary List of Best Practices for Non-Residential HVAC Programs

Program Theory and Design
• Develop a sound program plan; if possible have a clearly articulated program theory • Analyze region-specific HVAC system performance and promote products optimized to system needs • Leverage national efforts to increase efficient product availability • Include features targeting supply-side actors
Program Management: Project Management
• Clarify requirements for implementation through the application and contracting processes • Select, install and train a management structure that has sufficient skill and infrastructure to cope with the entire spectrum of the HVAC market, from manufacturer to installer
Program Management: Reporting and Tracking
• Articulate the data requirements needed to measure success • Conduct regular checks of the tracking reports to assess how the program is working and make program corrections to ensure success • Use incentive commitment tracking • Track and utilize contractor and equipment information that aids in analyzing and reporting actual installed efficiency • Utilize databases that fully integrate with cross-program energy-efficiency program information systems • Utilize electronic workflow management and Web-based communications
Program Management: Quality Control and Verification
• Develop inspection and verification procedures during the program design phase • Consider administrative cost in designing the verification strategy • Utilize inspection and verification as a training tool for market participants • Build statistical features into the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work • Base quality control practices on a program's relationship with vendors, the number of vendors, the types of measures, the project volume, and the variability in the size of projects • Require pre-project inspections for large projects with highly uncertain baseline conditions that significantly affect project savings • Require post-project inspections and commissioning for all large projects and projects with highly uncertain savings
Program Implementation: Participation Process
• Review and understand product availability before establishing product eligibility • Publish program application documents on the Internet • Provide assistance in preparing and submitting program applications through outreach events and workshops and through online help tools • Minimize documentation requirements • Offer incentives – particularly to upstream market actors • Provide AC contractors training on selling and proper installation practices • Utilize electronic processing • Try to maintain some availability of program funds throughout the program year

Exhibit NR2-E2
Summary List of Best Practices for Non-Residential HVAC Programs (Continued)

Program Implementation: Marketing & Outreach
• Cooperate with contractors to get the message out • Communicate with customers through multiple media • Assemble and use information about the target consumer demographics • Leverage marketing dollars through cooperative marketing efforts, sponsorship by manufacturers and through coordination with national or regional efforts to promote similar products • Use the program's Web site to broadly inform the market and attract participation • Keep energy efficiency service providers well informed about program features and changes through seminars, training sessions, trade shows, and annual meetings of key groups • Market energy efficiency options directly to large end-users at the earliest decision-making stages of major equipment or facility modifications • Conduct on-going training of account managers and other marketing staff to keep abreast of the latest efficiency technologies and practices
Program Evaluation
• Periodically review and update market-level information about HVAC 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 • Perform market assessments routinely, though not necessarily annually • Present actionable findings to program managers at the conclusion of study • Conduct both process and impact evaluations routinely • Include estimation of free-ridership and spillover

Exhibit NR2-E3
Summary of Best Practices Rationales for Non-Residential HVAC Programs

Best Practice	Rationale
Program Theory and Design	
Develop a complete and well thought-out program plan	Consider the plan from the perspective of each program participant, whether the utility administrator, a supply-side actor, or the consumer. Emphasize elements that facilitate participation. Rethink and discard, if possible, program elements that deter participation.
Analyze region-specific HVAC system performance and promote products optimized to system needs	HVAC units are relatively unique despite attempts to standardize EER and SEER ratings. The actual performance of units can differ significantly from expected performance estimated from laboratory ratings because of local climate conditions, mismatching of coils (split systems), and other factors. Programs should have clear and specific performance requirements that are tailored to system priorities (e.g., peak versus energy savings).
Leverage national efforts to increase efficient product availability	Cooperating with and re-enforcing national efforts (e.g., CEE, ASHRAE) to increase the availability of efficient equipment has been effective in the past and will continue to be important as stringent new federal and state standards are implemented.
Include program features targeting at least the supply-side actors in the program design	Programs targeting end-users work better in combination with additional features targeting supply-side actors. Programs targeting supply-side actors alone appear capable of influencing the market.
Program Management: Project Management	
Clarify requirements for implementation through the application and contracting processes	The choice of implementing structure is less important than providing program participants with clearly defined procedures for program application and incentive qualification.
Select, install and train a management structure that has sufficient skill and infrastructure to cope with the entire spectrum of the HVAC market, from manufacturer to installer	The HVAC industry is large and complex, with many market actors affecting final installed equipment efficiency. Manufacturers, distributors, specification-specialists, contractors, installers, and maintenance technicians must all be "on board" with the program objectives, understand program requirements, and have the skills to implement them. Management processes that address each stage of the distribution chain will help ensure that purchased efficiency is actually achieved.

Best Practice	Rationale
Program Management: Reporting and Tracking	
Articulate the data requirements needed to measure success	The database system should be designed and scaled according to program complexity. Frequently, off-the-shelf customer/contact tracking systems can form the foundation for the less complicated programs, but such systems cannot capture many of the equipment and installation details needed to track equipment efficiency. Larger relational databases incorporating program funding, savings algorithms, and other market data are more suitable for programs addressing multiple markets and equipment types.
Conduct regular checks of the tracking reports to assess how the program is working and make program corrections to ensure success	Continuous monitoring and review allows administrators to adjust the program as soon as the need arises.
Use incentive commitment tracking	Guarantees funds to customers (useful for larger customers and customized measures with longer project cycles), helps the program administrator anticipate expenditures. This can be particularly useful when tied into an online system accessible to program applicants.
Track and utilize contractor and equipment information that aids in analyzing and reporting actual installed efficiency	Greater certainty in program impacts can be derived from a robust system to capture specifics such as make and model (including matched coils for split systems) and contractor installation practices.
Utilize databases that fully integrate with cross-program energy-efficiency program information systems	Integration facilitates management review. Cross-program integration helps prevent double dipping, where more than one program might provide incentives the same measure or service.
Utilize electronic workflow management and Web-based communications	Electronic application processing and Web-based communication can help to improve project turnaround, reduce administrative costs, and maintain an electronic history of project correspondence.
Program Management: Quality Control and Verification	
Develop inspection and verification procedures during the program-design phase	Aspects of verification procedures that should not be neglected include: • Characteristics that affect equipment nameplate efficiency (model numbers to verify matched components) • Aspects of proper installation the assure peak performance (proper sizing, system commissioning, proper sizing)

Best Practice	Rationale
Consider administrative cost in designing the verification strategy	Increase the sample size in relation to project complexity or size. Unnecessary verification activities consume resources that could be devoted to producing additional energy savings.
Utilize inspection and verification as a training tool for market participants	Its main function is to ensure that program expenditures are well spent – program administrators need not absorb contractors' cost of quality control to make an effective program.
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.
Base quality control practices on a program's relationship with vendors, the number of vendors, the types of measures, the project volume, and the variability in the size of projects	A prescriptive rebate program with no control over vendors may need to require more quality control-oriented inspection. A turnkey program that trains a small pool of vendors and utilizes a pre-screened list of products may require less ex-post product quality review.
Require pre-project inspections for large projects with highly uncertain baseline conditions that significantly affect project savings	Savings cannot be reliably estimated for some types of projects on purely an ex-post basis. Pre-project inspections are an important part of developing defensible savings for projects such as complex compressed air and industrial process retrofits.
Require post-project inspections and commissioning for all large projects and projects with highly uncertain savings	Post-project inspections are critical for large projects. Very large and complex projects should also require some level of commissioning to establish that the new equipment or process is not only installed but also operating and functioning as designed. Invoices should be required and reviewed for all projects.
Program Implementation: Participation Process	
Review and understand product availability before establishing product eligibility	As equipment availability improves, efficiency standards can be made more stringent.
Publish program application documents on the Internet	Several utilities utilize the Internet to promote their programs. A natural extension of learning about the program is to make the call to action and provide an immediate means to do so.

Best Practice	Rationale
Provide assistance in preparing and submitting program applications through outreach events and workshops and through online help tools	Enlist contractors' and vendors' help in preparing applications on behalf of the customer.
Minimize documentation requirements	Documentation that requires duplicative effort from program participants reduces program effectiveness. Design programs to work around the type of documentation already used in the market.
Offer incentives – particularly to upstream market actors	Incentives can prompt dealers to promote high efficiency air conditioners and customers to consider the high efficiency alternative. A large number of installations are prompted by unit failures, frequently putting the decision-making process in a crisis mode. Upstream market actors are in the best position to influence a reasoned approach and encourage high efficiency equipment.
Provide AC contractors training on selling and proper installation practices	The contractor typically has the last chance to convince a customer to make an energy efficient choice and to ensure proper installation. Sales and installation training helps move the market towards greater efficiency.
Utilize electronic processing	Electronic application processing improves the program implementer's responsiveness and reduces administration cost.
Try to maintain some availability of program funds throughout most of the program year	Maintaining funds throughout most of the program year gives trade allies the confidence that they can sell the benefits of participation without concern that their customers will make a decision to install a project based on the program only to find out that funds are unavailable. It also provides customers with the confidence that they can apply for the program at the appropriate point in their decision-making process, rather than feeling pressured to apply quickly simply to reserve funds.
Program Implementation: Marketing and Outreach	
Cooperate with contractors to get the message out	The greater the number of sources recommending the same course of action, the more likely consumers will perceive and act upon the message. Contractors are the last expert with whom customers will communicate before their equipment decision is final.
Communicate with customers through multiple media	Combine bill inserts, brochures, the Internet, 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.

Best Practice	Rationale
Assemble and use information about the target consumer demographics	The message should be tailored differently for clearly distinct audiences. Multilingual communications are important in some areas. It is also important to choose the correct media. Mass market communication schemes are not suitable for large chiller projects, but may be for targeting customers.
Leverage marketing dollars through cooperative marketing efforts, sponsorship by manufacturers and through coordination with national or regional efforts to promote similar products	A regional commitment to high efficiency products can help manufacturers get onboard with producing, stocking and promoting high efficiency equipment. Manufacturer and distributor support will help both the salesperson and the customer agree on the benefits and economics of a properly installed high efficiency system.
Use the program's Web site to broadly inform the market and attract participation	Because the large non-residential market is made up of a small population of well-informed customers and efficiency service providers, driving prospective participants to a comprehensive program Web site is often effective without significant other investments in traditional advertising. This can also be a low-cost and effective way to match the timing of the message to the timing of the transaction – a critical component of a successful HVAC marketing effort.
Keep energy efficiency service providers well informed about program features and changes through seminars, training sessions, trade shows, and annual meetings of key groups	To keep private sector marketing efforts effective, it is important to provide outreach and offer training on both on-going program details and periodic program updates.
Conduct on-going training of account managers and other marketing staff to keep abreast of the latest efficiency technologies and practices	Keeping up with the latest technical information is critical to maintaining credibility among large end-users and their service providers. The importance of properly installing and commissioning HVAC systems should be a central theme of program training and communication.
Program Evaluation	
Periodically review and update market-level information about HVAC distributor and contractor installation practices and consumer awareness of benefits associated with high efficiency, matched systems, proper sizing and proper installation practices	Policy and market changes will affect the suitability of program design elements. Without periodic adjustments, program impacts and cost-effectiveness will diminish.
Periodically review and update algorithms for calculating project savings	Regulatory, technology and other market changes will alter baseline efficiency assumptions; they also afford the opportunity to "raise the bar." Even if market aspects are unchanged, new insights to deriving savings algorithms might result in program improvements.

Best Practice	Rationale
Perform market assessments routinely, though not necessarily annually	Market assessments should occur when the market or program design change significantly.
Present actionable findings to program managers at the conclusion of study	Presentations bring implementers into the feedback loop and encourage them to act on study recommendations.
Conduct both process and impact evaluations routinely	Large customer programs and markets are very dynamic and require regular assessment in order for program managers and policy makers to continuously improve them. They are also often the largest programs in an administrator's portfolio and hence require close monitoring.
Include estimation of free-ridership and spillover	Although measuring free-ridership and spillover can be challenging, there is usually critically important knowledge gained about program effectiveness through these analyses. Free-ridership and spillover measurement often provide the most actionable and practically useful information in an evaluation. It is important, however, for parties to agree upfront on how results will be used, particularly with respect to any performance rewards or penalties for program administrators.

1. OVERVIEW OF REVIEWED PROGRAMS

The Best Practices research team reviewed six Non-residential HVAC programs for this report, each of which focused on increasing the efficiency of Non-residential HVAC systems. Each program represents a distinct approach to C&I HVAC efficiency.

- **2002 New England Efficiency Partnership's (NEEP) Cool Choice Program**. This program pays cash rebates to commercial and industrial customers to help defray the cost of buying high-efficiency HVAC systems. The rebates cover up to 80 percent of the incremental cost for qualifying, air-cooled systems and economizers.

- **2001 Avista Rooftop HVAC Maintenance Program.** Avista rapidly designed and implemented a commercial air conditioner maintenance program in response to energy market conditions in the summer of 2001. The program objective was to save electricity by reducing electric usage in commercial rooftop heating and cooling units through maintenance, repair, and equipment upgrades. HVAC dealers were enlisted to conduct a 14 point service checklist that emphasized equipment cleaning, parts replacement, and repair.

- **2002 California Express Efficiency Program – HVAC Element**. This program offers rebates of up to $25,000 for small and medium sized non-residential customers (•500 kW/month) for any combination of eligible energy efficient equipment replacement, including HVAC.

- **2002 Los Angeles Department of Water and Power** (LA DWP) Chiller Efficiency Program.[1] LA DWP offers cash rebates for qualifying, high efficiency water-cooled chillers. The rebates are designed to cover a sufficient portion of the incremental cost to encourage customers to exceed baseline efficiency.

- **2002 Florida Power and Light (FPL) Commercial and Industrial (C/I) HVAC Program**. FPL's C/I HVAC program influences the selection of high efficiency air-conditioning equipment through incentives to buy-down the first cost of high efficiency systems including direct expansion, packaged terminal, chiller, and thermal energy storage systems. For thermal energy storage, incentives are also included for the development of feasibility studies, for design assistance, and system commissioning.

- **2001 Glendale Water and Power (GWP) CheckMe!® Program**. This program uses customer and contractor incentives to encourage use of Proctor Engineering Group's (PEG) proprietary CheckMe! computer diagnostic system. The system tests the status of air conditioners' refrigerant charge and air-flow and measures leakage in the duct systems. Measurement results are called-in to PEG's CheckMe! call center, where it is analyzed and repair recommendations are made back to the technician. Subsequent

[1] LA DWP's Chiller Efficiency Program details span several years. The principal year under review is 2002.

technician repairs are tracked and verified by a second CheckMe! test and call to the call center.

A few summary characteristics of each program are provided in Exhibit NR2-1. Additional data and program characteristics are summarized in the remainder of this chapter. Readers will note that not all data fields are complete. Detailed interviews were conducted with program managers representing each program included in our analysis. As part of the interviews, the same data elements were requested for each program. However, not all of the requested data were available or received. In addition, our goal was to obtain the data for a consistent target program year. The targeted program year was selected in consultation with each program manager to be the most recent year for which the most complete and representative data were available.[2] Another goal was to obtain ex-post data on actual program expenditures and accomplishments; however, in some cases only budgeted and planned accomplishments were available at the time of this writing. Issues, limitations, and recommendations associated with data availability and inconsistencies are discussed in detail in *Volume 2 - Summary of Program Characteristics and Outcomes* and *Volume Y – Methodology*.

[2] The default target year for the current effort was calendar year 2002, or the closest corresponding program year. Some programs are not run on calendar years, while others are tracked on a multi-year not single year basis.

Exhibit NR2-1
Non-residential HVAC Programs

Item	2002 NEEP Cool Choice	2001 Avista Rooftop HVAC Maintenance	2002 CA Express Efficiency[3]	2002 LA DWP Chiller Efficiency	2002 FPL C/I HVAC	2001 GWP CheckMe!
Period Reviewed	2002	2001	2002	See footnote 1 on page 11.	2002	2001
Context	Introduced mid-1999	One-time program in response to low-hydropower resources	Component of a multi-year comprehensive program	Multi-year program established in response to 2001 power crisis	Multi-year program to reduce summer and winter peak	Introduced in 2001 during CA power crisis
Average Retail price /kWh[4]	$0.09	$0.069	$0.156	$0.104	$0.067	$0.116
Program Budget	$2,312,195	$1,750,000	NA	$786,430 (2003-04)	$5,434,000	$150,000
Total Incentives Paid	NAV	NAV	$462,839	$686,430 (2003-04)	$4,445,000	$68,000
Eligible Facilities	1 million C&I customers	25,000	300,000	NAV	532,458	50,000[5]
Net MWh goal	NAV	NAV	NAV	NAV	NAV	NAV
Net kW goal	NAV	NAV	NAV	10,400 (2002)	NAV	NAV
MWh achieved	3,929	13,000	2,901	7,174.3 (2003-04)	N/A	25,128
KW achieved	3,518	NAV	NAV	5,666 (2003-04) 20,500 (2002)	NAV	358
Unique Participants	Tier 1: 1390 units; Tier 2: 1453 units; Economizers: 403	2,700	389	26 Chillers 14,855 tons (2003-04)	523	600

[3] Incentive and MWh values include only the AC component of the express efficiency evaluation results. Overall Express Efficiency budget and program perspective is provided in a separate volume of this study: *NR1 – Non-residential Lighting Programs.*

[4] Based on Table 15: Class of Ownership, Number of Bundled Ultimate Consumers, Revenue, Sales, and Average Revenue per Kilowatt-hour for the Commercial 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.

[5] GWP customers with electric air conditioning.

2. CONTEXT

2.1 POLICY ENVIRONMENT

Utilities and regulators have long recognized that commercial HVAC represents a significant energy efficiency resource. Despite this recognition, several factors have served to constrain the role of commercial HVAC programs in the common utility's energy efficiency program portfolio. Improving technology, a greater appreciation for the significance of the commercial HVAC market, and the recognition that poor installation and maintenance practices are as pervasive in the commercial sector as the residential, have combined to increase attention and funding on commercial HVAC opportunities.

The policy environment both affects and reflects program design parameters. Successful utility market transformation efforts have facilitated increases in federal standards, as well as in efficiency guidelines and standards published by organizations such as the Consortium for Energy Efficiency (CEE) and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). As these organizations incrementally increase applicable standards and baseline efficiencies, utilities respond with ever-more aggressive and innovative approaches, facilitating further increments in efficiency by the standards organizations. While this is a desirable cycle, it nevertheless places a burden on program planners to better understand both the technologies and the markets affecting HVAC efficiency.

Accordingly, the Northeast Energy Efficiency Partnerships established its Cool Choice program in 1998 to help increase availability of high efficiency equipment and improve installation practices of HVAC contractors within the targeted region (Connecticut, Rhode Island, Vermont, Massachusetts, and New Jersey during the study period). The 2002 Cool Choice program educated HVAC contractors on up-selling HVAC efficiency during normal replacement and encouraged proper installation practices. Cool Choice utilizes the CEE guidelines for energy efficiency, which in 2002 included both a Tier 1 and Tier 2 level. (CEE's current specifications include only a Tier 2 guideline.) Customers received an incentive based on the incremental efficiency improvement. The policy environment affecting NEEP's program has remained stable since the program's inception.

Low hydropower generation capacity in 2001 prompted Avista Utilities to develop its commercial HVAC maintenance program. Additional market factors converged to drive electricity prices to $400/MWh. These resource and price factors created the need for a rapidly deployed efficiency program. The low entry and exit cost associated with maintenance programs allowed Avista to introduce the program in time to affect market conditions during the crisis period, then to substantially modify the program when market conditions reduced its cost-effectiveness. It is no longer operated as originally designed.

California's Express Efficiency program has been offered statewide by California's investor-owned utilities (IOUs) since 1999, although each California IOU previously offered similar prescriptive rebate programs. The 2002 program focused on end-user incentives; however, in earlier program years, some utilities also provided upstream incentives to HVAC distributors. The 2002 program saw statewide modifications that affected delivery efficiency, including an account aggregation requirement and requirements that utilities target hard-to-reach (HTR) areas and markets. The 2002 program was affected by a late start date, low rebate levels, and the

requirement loads be aggregated for eligibility. Finally, other third-party programs competed with the Express Efficiency program, particularly in providing higher incentive levels to small customers in limited geographic regions.

The Los Angeles Department of Water and Power's Chiller Efficiency program was initially funded through a California Energy Commission grant in response to the 2001 energy crisis. The program first focused on encouraging early replacement of inefficient chillers. The program presently promotes high efficiency chillers and is funded through the public goods charge. The program far exceeded its first program year goal of 13 MW of efficiency resources, reaching 100 MW of savings.

Florida Power and Light's Commercial and Industrial HVAC program is well established, having undergone relatively little design adjustment in recent years, other than routine adjustments to the incentive levels, most recently in June 2000. Recent changes in FPL's program include program component additions, like ventilation measures, and changes in emphasis. Also, goals for thermal energy storage (TES) were accelerated in recent years. This increased emphasis on TES anticipates an expected reduction in savings from other HVAC measures, brought on by Florida's adoption of ASHRAE 90.1, and an expected reduction in chiller and DX incentives.

Glendale Water and Power Service established its CheckMe! program in 2000. The 2001 program year was affected by the news coverage given the energy crisis of that year. Initial participation goals were considered aggressive, so the program has not been as successful as hoped, primarily the result of participating contractors having a smaller customer base than anticipated.

2.2 PROGRAM STRATEGY AND GOALS

Aging and poorly maintained commercial air conditioning contributes significantly to resource inefficiencies in generating capacity and production. Each of the programs reviewed sought to mitigate such inefficiencies by promoting efficient commercial HVAC. Some programs indicated greater interest in energy savings, while others were more concerned with peak demand savings. There was also variation in the means to produce those savings. NEEP's and FPL's programs were very comprehensive in their approach. Others, such as the LA DWP and the California Express Efficiency program, focused primarily on incentives for equipment replacement. Finally, two programs (Avista's and GWP's) sought shorter-term energy savings potential afforded by equipment maintenance and repair programs.

NEEP's 2002 Cool Choice was one of the most comprehensive programs reviewed. Its goal was to achieve significant energy and peak load savings by improving contractor techniques for sizing, selecting and installing HVAC systems and by establishing high efficiency unitary HVAC systems as the first choice of consumers and professionals in the market. The 2002 Cool Choice program paid cash rebates to commercial and industrial customers to help defray the cost of buying high-efficiency HVAC systems. In most cases, these rebates covered up to 80 percent of the incremental cost for qualifying equipment.

Initially, Avista's Rooftop HVAC Maintenance program sought to achieve one goal – to mitigate the effects of the Summer 2001 hydroelectric and regional energy crisis. Through rapid deployment of its commercial HVAC maintenance program, Avista was able to produce

avoided energy at half the then-current electricity price of $400/MWh. Once the crisis period ended and high prices abated, Avista believed the program became non-cost-effective as designed.

CA 2002 Express Efficiency's goal was to produce long-term cost-effective energy savings, although there were additional program equity goals. The resultant strategic focus on targeting hard-to-reach customers and limiting eligibility to aggregated loads of 500 kW or less in some ways conflicted with the energy savings goal and served to reduce overall effectiveness.

The Los Angeles Department of Water and Power's 2002 Chiller Efficiency program goal was to cost-effectively reduce peak demand by promoting the installation of high-efficiency chillers at the time of natural replacement.

Florida Power and Light sought to reduce coincident summer and winter peak demand by increasing the use of high efficiency heating, ventilation and air-conditioning (HVAC) systems and encouraging the early replacement of inefficient HVAC equipment.

Glendale Water and Power Service's 2001 CheckMe! program goal was to produce electricity savings by improving existing commercial HVAC system efficiency. The program relied on contractors using Proctor Engineering Group's (PEG) proprietary program for air conditioning service technicians. Using refrigerant pressure and fan flow data, the CheckMe! program was used to identify system problems and produce repair recommendations that can significantly increase existing systems' operating efficiency.

Each of the programs the team reviewed identified specific barriers their program activities sought to address. On the end-user side, all of the programs reviewed for this study focused on various 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 commercial consumers to the value of energy efficient product features. On the market supply side, programs focused on overcoming various barriers related to product unavailability, as well as organizational practices or customs, particularly as they relate to installation practices and ongoing maintenance.

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, and the activities that may help to overcome them are described in Exhibit NR2-2. This is not to suggest that these are the only or even the most important barriers to C&I HVAC decisions, rather these constitute the current view of important barriers to Non-residential HVAC products as described by program manager interviewees and associated program filings and evaluation reports.

The barriers identified reflect an understanding of the non-residential HVAC market at the time these programs were designed. In practice, it is not always easy to determine whether a specific activity offers sufficient leverage or represents the most effective activity a program can undertake, or even which barriers are in most need of attention. Identified barriers must also be considered within the context of national initiatives adopted by government or industry associations. Such initiatives present program design challenges to produce incremental savings above increasing federal or local standards.

Exhibit NR2-2
Barriers and Related Activities

Identified Barrier	Activity
Information and Search Costs	Contractor training and customer education through news articles, bill inserts and the Internet help put contractors and customers on the same page when equipment replacement opportunities arise.
Product Unavailability	Close contact with manufacturers, coupled with national (e.g., CEE Tiers) and regional efforts to promote efficient equipment helps encourage manufacture production and distributor/contractor stocking of higher efficiency systems. Incentives help mitigate the higher supply chain costs associated with producing and marketing higher efficiency equipment.
Bounded Rationality	Rebates help overcome the higher costs associated with efficient technologies. Since commercial customers frequently require short payback periods, incentives are often designed to cover most or all of the incremental cost for the efficient equipment. The appropriate target (supply-side or demand-side) is an important issue; incentives targeted to supply-side actors may affect the other barriers cited with greater market effect than customer-targeted incentives. This barrier also is addressed primarily through marketing and training efforts to expose consumers and suppliers to the benefits of energy efficient equipment or practices.
Organizational Practices and Customs	In Non-residential HVAC, this barrier relates mainly to the reluctance of contractors and distributors to order, stock and promote energy efficient products and to the failure of commercial customers to create internal policies and procedures that ensure adoption of economic options.

3. COMPARISON OF PROGRAM COMPONENTS

This section compares the six programs across seven program components: program theory and design; project management; reporting and tracking; quality control and verification; participation process; marketing and outreach and program evaluation.

3.1 PROGRAM THEORY AND DESIGN

None of the programs reviewed in this study developed a formal program theory. This is not to say that the programs reviewed are founded on unsound concepts. Rather, program planners, implementers, and other stakeholders use more informal processes to contribute their expertise and experience to program design.

Such is the case with NEEP's 2002 Cool Choice program. Together, interested parties developed a consensus view of needs, building on the utilities' existing programs. Concepts that contributed to success included simplicity, economies of scale (through regional program), and a focus on packaged AC as the most common and easily understood commercial system. The program design is continuously reviewed and updated. The regional model did present trade-offs; for example, some individual utility program elements could not translate well to the regional model.

California's predecessor 1998 PG&E Express program had a program theory developed, but this was done by evaluators, not program planners. Some aspects of a formal theory were required, however, by the CPUC in the California utilities' program proposals for the 2002 Express program (for example, the CPUC's proposal and implementation requirements include identification of market barriers addressed, market actors and segments targeted, and potential market effects).

Avista, LA DWP, FPL, and GWP each reported program designer or manager experience and empirical research to support program design.

Best Practices

Program Theory and Design
• Develop a sound program plan; if possible have a clearly articulated program theory. • Analyze region-specific HVAC system performance and promote products optimized to system needs. • Leverage national efforts to increase efficient product availability. • Include features targeting supply-side actors.

- **Develop a sound program plan; if possible have a clearly articulated program theory**. Articulate a program theory that clearly states the target for the program, program timing and the strategic approach whether resource acquisition or market

transformation. Even a relatively simple statement of program logic can reveal gaps in program focus or effort and assure that everyone involved knows what the program seeks to accomplish and why.

- **Analyze region-specific HVAC system performance and promote products optimized to system needs.** HVAC units are relatively unique despite attempts to standardize EER and SEER ratings. The actual performance of units can differ significantly from expected performance estimated from laboratory ratings because of local climate conditions, miss-matching of coils (split systems), and other factors. Programs should have clear and specific performance requirements that are tailored to system priorities (e.g., peak versus energy savings).

- **Leverage national efforts to increase efficient product availability.** Cooperating with and re-enforcing national efforts (e.g., CEE, ASHRAE) to increase the availability of efficient equipment has been effective in the past and will continue to be important as stringent new federal and state standards are implemented.

- **Include features targeting supply-side actors.** Programs targeting end-users work better in combination with additional features targeting supply-side actors. Programs targeting supply-side actors alone also appear capable of influencing the market; however, end-user re-enforcement is also critical to achieving significant market share.

3.2 PROGRAM MANAGEMENT: PROJECT MANAGEMENT

In this section, we discuss several aspects of program management, specifically, **project management**, **reporting and tracking verification, measurement, and quality control**. 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 efficiently be translated into reporting effective information. Verification, measurement, and quality control include accountability and safeguard processes that are typically carried out through implementation and evaluation activities.

As detailed in Exhibit NR2-3, program implementers used more than one approach to manage and implement the six comprehensive programs reviewed by the research team. Most managed their large non-residential HVAC program entirely in-house (Avista, California Express Efficiency, LA DWP, FPL, and Glendale). NEEP outsourced management responsibility to an outside implementer, and Glendale's proprietary program relies heavily on an outside contractor for technical services. Program results suggest that the structure of program management appears less important than how well the program activities are in line with program objectives and market characteristics.

Regardless of management approach, keys to sound project management include application and contracting procedures that maintain a clear focus on the program's objectives, and selection of a management structure that has sufficient skill and infrastructure to cope with the entire spectrum of the HVAC market, from manufacturer to installer. Sound management practices that address each level of the supply chain are particularly important in the HVAC market to ensure smooth program delivery and that installed equipment performs at the

highest possible efficiency. The C&I HVAC program management approaches reviewed are summarized in Exhibit NR2-3.

Exhibit NR2-3
Program Management Approaches

Program	How Implemented
NEEP Cool Choice	Multi-state coordination and administration by New England Efficiency Partnership organization and contracted to a single implementer.
Avista Rooftop HVAC Maintenance	With in-house management, utility personnel enlist contractor participation, and provide training with the 14-point checklist for contractors' use. The utility provides follow-up inspection and arranges corrective action, including supplemental training, if required.
CA Express Efficiency	In-house management is used to operate the program. Customer and contractors learn about the program through various utility communication channels. Customers apply for reservation to ensure funding availability. Contractor, customer and community outreach is used to reach the target audience.
LA Chiller Efficiency	In-house management is used to provide direct contact with potential customers. That contact, coupled with marketing efforts of two key manufacturers (Trane and Carrier), produce sales leads. Trade allies are responsible for selling customers on chiller replacement.
FPL C/I HVAC	In-house management provides the contractor and customer outreach needed to secure program participation.
GWP CheckMe!	Contractors with a base of refrigerated air customers are used to identify and market to eligible customers.

Best Practices

Program Management: Project Management
• Clarify requirements for implementation through the application and contracting processes. • Select, install and train a management structure that has sufficient skill and infrastructure to cope with the entire spectrum of the HVAC market, from manufacturer to installer.

- **Clarify requirements for implementation through the application and contracting processes.** The choice of implementing structure is less important than providing program participants with clearly defined procedures for program application and incentive qualification.

- **Select, install and train a management structure that has sufficient skill and infrastructure to cope with the entire spectrum of the HVAC market, from manufacturer to installer.** The HVAC industry is large and complex, with many market actors affecting final installed equipment efficiency. Manufacturers, distributors, specification-specialists, contractors, installers, and maintenance technicians must all be "on board" with the program objectives, understand program requirements, and have the skills to implement them. Management processes that address each stage of the distribution chain will help ensure that purchased efficiency is actually achieved.

3.3 PROGRAM MANAGEMENT: REPORTING AND TRACKING

Each of the program managers reported using fairly basic reporting and tracking systems, although it is evident that all programs collect the information needed to adequately manage and report results. The NEEP 2002 Cool Choice tracking system monitored milestones, expedited incentive payments, and prepared regulatory and management reports. Individual partner systems had additional features, such as NU's, which incorporated spreadsheets to calculate savings and feed a relational database.

Avista used an off-the-shelf database as its account management tool. The program tracked location, measure, and cost data. It was capable of tracking information by specific packaged rooftop system since that was the nature of the payment and savings calculation. The system's ability to scan and display documents online was an important feature.

California's 2002 Express Efficiency system exhibited varying degrees of sophistication depending on the administering utility. Generally, the systems tracked application information from a central processing group, which, when linked to reservation information, tracked how quickly funds are committed. This system allowed program accomplishments to be efficiently aggregated for regulatory reporting, especially for reporting programs towards hard-to-reach goals. This Marketing Decision Support System (MDSS) tracking system is very comprehensive and accessible. In addition, the toll-free phone reservation system is somewhat innovative.

The Los Angeles Department of Water and Power 2002 Chiller Efficiency Program used an Aurum customer-tracking database primarily for tracking customer information. Other documentation was maintained, including performance calculations, audit results, contact history, and equipment nameplate information. Much the same information was also tracked by Florida Power & Light's program manager for its 2002 C/I HVAC program. FPL tracked units sold, projects completed, equipment type and capacity, tons shifted (for TES), efficiency, and model information.

Glendale's 2001 CheckMe! program was tracked within the operating system utilized by Proctor Engineering to implement the program. Records regarding location, equipment information, install dates and diagnostic/repair results were maintained to support reporting billing, savings and market status information to GWP.

Exhibit NR2-4
Reporting and Tracking Tools

Program	Method
NEEP Cool Choice	The NEEP Cool Choice tracking system monitors milestones, expedites incentive payments, and prepares regulatory and management reports.
Avista Rooftop HVAC Maintenance	Off-the-shelf system tracks location, measure data, and costs, including information at the individual rooftop unit level.
CA Express Efficiency (See *NR1 – Non-residential Lighting* report for more details)	Tracks application and reservation information to monitor how quickly funds are committed. The system allows program accomplishments to be efficiently aggregated for regulatory reporting, especially for reporting programs towards hard-to-reach goals.
LA Chiller Efficiency	An Aurum customer tracking database tracks customer information. Other hardcopy documentation is maintained, including performance calculations, audit results, contact history, and equipment nameplate information.
FPL C/I HVAC	FPL tracks units sold, projects completed, equipment type and capacity, tons shifted (for TES), efficiency, model information.
GWP CheckMe!	CheckMe! provides records regarding location, equipment information, install dates and diagnostic/repair results to report billing, savings and market status information to GWP.

While the overall goals of the tracking system will reflect the characteristics of the organization and its reporting requirements, program managers consistently stressed the need to track information to monitor progress and to report savings. In some cases, it appears that the tracking and reporting systems have not been substantially integrated with the program management and implementation functions of the administering utilities.

Best Practices

Program Management: Reporting and Tracking
• Articulate the data requirements needed to measure success. • Conduct regular checks of the tracking reports to assess how the program is working and make program corrections to ensure success. • Use incentive commitment tracking. • Track and utilize contractor and equipment information that aids in analyzing and reporting actual installed efficiency. • Utilize databases that fully integrate with cross-program energy-efficiency program information systems. • Utilize electronic workflow management and Web-based communications.

- **Articulate the data requirements needed to measure success.** The database system should be designed and scaled according to program complexity. Frequently, off-the-shelf customer/contact tracking systems can form the foundation for the less complicated programs, but such systems cannot capture many of the equipment and installation details needed to track equipment efficiency. Larger relational databases incorporating program funding, savings algorithms, and other market data are more suitable for programs addressing multiple markets and equipment types.

- **Conduct regular checks of the tracking reports to assess how the program is working and make program corrections to ensure success.** Several programs reported that tracking report review was very important for their ability to monitor the program and make adjustments as the need arose.

- **Use incentive commitment tracking.** Guarantees funds to customers (useful for larger customers and customized measures with longer project cycles), helps the program administrator anticipate expenditures. This can be particularly useful when tied into an online system accessible to program applicants.

- **Track and utilize contractor and equipment information that aids in analyzing and reporting actual installed efficiency.** Greater certainty in program impacts can be derived from a robust system to capture specifics such as make and model (including matched coils for split systems) and contractor installation practices.

- **Utilize databases that fully integrate with cross-program energy-efficiency program information systems.** Integration facilitates management review. Where more than one program might provide incentives for the same measure or service, cross-program integration helps prevent double-dipping.

- **Utilize electronic workflow management and Web-based communications.** Electronic application processing and Web-based communication can help to improve project

turnaround, reduce administrative costs, and maintain an electronic history of project correspondence.

3.4 PROGRAM MANAGEMENT: QUALITY CONTROL AND VERIFICATION

Quality control (QC) and measure verification are an important component of HVAC 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, and the ability to ensure that proper sizing and installation practices are adopted.

Each of the program managers described mechanisms to ensure quality control. The possibility of physical inspection helps ensure the integrity of the installation contractors. Administrators performed on-site verification of a random sample of standard systems and sometimes 100 percent of large plant/thermal storage systems. QC efforts generally focus on equipment eligibility, consistency with reported results, and installation quality.

Individual partner utilities in the NEEP 2002 Cool Choice program performed inspection and verification on at least a sample of sites. In some instances, the verification equated to a low-level commissioning, although not to the extent of performance testing.

Avista program staff also performed inspections, checking the individual maintenance points addressed in the check-up (although without gauges). Problem contractors were subjected to 100 percent inspection until their results conformed to program parameters. Avista also found a need to ensure that each application was unique, since multiple contractors occasionally serviced the same unit.

California's 2002 Express Efficiency program quality control varied somewhat by utility, although all performed at least random on-site visual inspections, usually targeting at least 20 percent of installations. QC was applied to 100 percent of installations if a utility administrator sensed specific program problems that could be avoided through more comprehensive inspection requirements.

The Los Angeles DWP 2002 Chiller program relied on manufacturers' factory representatives to perform post-installation performance verification. Performance test measurements taken at the time of installation are used to establish incentives. LA DWP conducted site inspections of 100 percent of projects after installation.

Florida Power and Light implemented verification for a sample of participating customers to ensure that contractor and designer reporting is accurate and to correct deficiencies. Quality control was completed using a number of channels, including a program provision for contractor training and certification, and regular program evaluations. For the DX and chiller program components, FPL performed on-site verification of equipment make and model and of all other relevant program standards. For TES, FPL also reviewed the feasibility study to ensure that expected tons shifted would be achieved.

FPL also interviewed participating and nonparticipating program contractors to gain feedback on the program process and its effects on the HVAC market. Other relevant interviews were

completed with equipment suppliers, designers, controls contractors, FPL representatives, and manufacturers to fully address delivery throughout the equipment supply chain.

Glendale's 2001 CheckMe! program addressed quality control at the contractor and customer level, with procedures and statistical analyses that helped identify inadequate performance at the service delivery level. If problems were found, the contractor was contacted and the jobs re-inspected. Since measurements were taken before and after installation of recommended measures, the statistical analysis was able to identify likely anomalies. As a result, program administrators could be fairly comfortable in the accuracy of reported impacts.

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. • Utilize inspection and verification as a training tool for market participants. • Build statistical features into the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work. • Base quality control practices on a program's relationship with vendors, the number of vendors, the types of measures, the project volume, and the variability in the size of projects. • Require pre-project inspections for large projects with highly uncertain baseline conditions that significantly affect project savings. • Require post-project inspections and commissioning for all large projects and projects with highly uncertain savings.

- **Develop inspection and verification procedures during the program-design phase.** Although this is common practice, aspects of verification procedures that may, but should not, be neglected include:
  - Characteristics that affect equipment nameplate efficiency (model numbers to verify matched components)
  - Aspects of proper installation the assure peak performance (proper sizing, system commissioning, proper sizing)

- **Consider administrative cost in designing the verification strategy.** Increase the sample size in relation to project complexity or size. Unnecessary verification activities consume resources that could be devoted to producing additional energy savings.

- **Utilize inspection and verification as a training tool for market participants.** Nevertheless, its main function is to ensure that program expenditures are well spent – program administrators need not absorb contractors' cost of quality control to make an effective program.

- **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.

- **Base quality control practices on a program's relationship with vendors, the number of vendors, the types of measures, the project volume, and the variability in the size of projects.** A prescriptive rebate program with no control over vendors may need to require more quality control-oriented inspection A turnkey program that trains a small pool of vendors and utilizes a pre-screened list of products may require less ex-post product quality review, although this approach is program specific.

- **Require pre-project inspections for large projects with highly uncertain baseline conditions that significantly affect project savings.** Savings cannot be reliably estimated for some types of projects on purely an ex-post basis. Pre-project inspections are an important part of developing defensible savings for large complex projects (usually chillers).

- **Require post-project inspections and commissioning for large projects and projects with highly uncertain savings.** Similarly, post-project inspections are critical for large projects. Very large and complex projects should also require some level of commissioning to establish that the new equipment or process is not only installed but also operating and functioning as designed. Invoices should be required and reviewed for all projects.

3.5 PROGRAM IMPLEMENTATION: PARTICIPATION PROCESS

The participation process varied between programs according to the target audience, although a common thread among programs is 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. NEEP's 2002 Cool Choice program relied on an implementation contractor who provided outreach to HVAC contractors, who, in turn, provided outreach to customers. The HVAC contractors and distributors identified leads and enrolled participants in the program.

When equipment replacement was necessary, contractors used available incentives to help promote the higher efficiency equipment. The idea was to make the process simple and hard to refuse. NEEP's 2002 Cool Choice incentives were designed to cover 80 percent of incremental costs for purchasing and installing energy-efficient air conditioning system of up to 30 tons. NEEP promoted equipment that complies with CEE energy efficiency tiers. (Originally Tier 1 and Tier 2 equipment was eligible. Today, Tier 1 is code in New Jersey and equipment must meet Tier 2 minimums.) NEEP's 2002 Cool Choice program also offered a stocking incentive to distributors to encourage them to stock energy efficient models, although NEEP cautions against this practice.

Avista recruited HVAC dealers to participate in its Rooftop HVAC Maintenance program. The contractors were trained on a 14-step maintenance checklist and then they were free to recruit participants and provide maintenance services free to customers. Avista supplemented the dealers' marketing with direct customer contact and mail to generate general program awareness. Greater success was achieved by the ease of participation incorporated in the program design, more customer contact would have helped the program.

California's 2002 Express Efficiency had operated in a fairly consistent format for a number of years. Customers installed an eligible measure, then filled out and submit the application with required documentation for the rebate. There was a process that allowed the customer to make a reservation in order to ensure funding. Often, contractors apprised the customer of the rebate and completed the incentive application for the customer.

The 2002 Express Efficiency program had minimal paperwork requirements, particularly with respect to standard performance contract programs. This was an important aspect of improving program effectiveness. Making program information and forms available online also helped simplify program participation. There was also information online and on the phone to help fill out the form. Multi-lingual forms and information were very important in several markets.

The Los Angeles DWP 2002 Chiller Efficiency program relied primarily on equipment vendors to bring in projects. Once the client submitted the application and funds were reserved, the customer's purchase order went out to the manufacturer's representative. Upon factory testing and installation, LA DWP and the customer executed the final contract. Executing the final contract at this stage prevented too many change orders. After the installation was verified, LA DWP made the incentive payment to the customer. While the process was fairly simple, one challenge was disparity between typical chiller sales cycles (16 – 19 months) and utility funding cycles (annual).

Florida Power and Light marketed its 2002 Commercial and Industrial HVAC program through advertising, flyers, its Web site, and utility representatives. FPL provided contractor training and certification. In turn, contractors and designers informed customers about high efficiency rebates for DX, chiller and TES cooling equipment.

For FPL's DX and chillers, FPL's contractors installed units and submitted paperwork for each rebate, and credited that amount back to the customer on their invoice. For TES, the designers submitted a feasibility study, providing analysis of expected peak demand shifts and other hourly load shape data, and also assessed the costs and benefits of the TES design and other available options. Based on the expected load shift from the feasibility study, incentive payments were made at project progress milestones, at 25, 50, 75, and 100 percent completion. Additional incentives covered design assistance and downstream commissioning.

Glendale's 2001 CheckMe! program was marketed to contractors who signed a contract with PEG in order to use the CheckMe! program tools. Once the contractor's field technicians completed training, they performed testing on customer equipment, using the telephone hotline to determine proper equipment repairs. Minor repairs were provided within the basic $35 diagnostic fee.

After repairs are made, the CheckMe! technician re-measured the performance parameters and called in results to verify the successful repair. The customer was given a certificate of

participation. PEG assembled contractor and customer data before submitting a bill, which triggered Glendale's payment to participating contractors. Contractors were paid by the tenth day of the month of service.

Exhibit NR2-5 summarizes key non-residential HVAC program tactics adopted by the program managers interviewed.

Exhibit NR2-5
Non-residential HVAC – Program Tactics

TACTIC	NEEP Cool Choice	Avista Rooftop HVAC Maintenance	CA Express Efficiency	LA DWP Chiller Efficiency	FPL C/I HVAC	GWP CheckMe!
Rely on trade allies for program marketing and delivery	Contractors provide outreach to customers.	Contractors were trained, then free to recruit customers using their best methods.	Partially – contractors use the program as a sales tool, but are not recruited to perform function.	Vendors are recruited to perform sales function.	FPL recruits and certifies contractors who market to customers.	Contractors participate in training then recruit customers for participation.
Contractor/ Distributor Training	Yes	Yes	Partial (through separate SW Education & Training Program)	No	Yes	Yes
Regional Coordination	Yes	No	Yes	No	No	No
Contractor Support/Upstream Buy-downs	Yes	Yes	No (some use of this in previous program years)	No	Yes, but credit amount back to customers.	Yes to provide free service to customers.

Exhibit NR2-6 summarizes insights and lessons learned by program staff interviewed for this study.

Exhibit NR2-6
Lessons Learned – Participation

Participation Tactic	Lessons Learned
Rely on trade allies for program marketing and delivery	• Simplify participation process • Contractor is the most influential party in most equipment purchase choices, especially during emergency replacements. Build on their sales and installation skills as well as access to customers.
Contractor/Distributor Training	• Do not assume that contractors already have either the sales or installation skills needed to promote, install and maintain high efficiency equipment.
Regional Coordination	• Economies of scale accrue to administrators and upstream market actors through regional programs.
Contractor Support/Upstream Buy-downs	• High efficiency is costly, not just in equipment costs, but in the overall transaction cost. Incentives help distributors stock and contractors promote the more efficient equipment. • Can exacerbate due diligence issues with regulators – reporting requirements will dictate how simple a buy-down strategy can be. • Investment can reduce the upstream price point and have a profound impact in the retail marketplace due to markup effects. • Can be a high leverage strategy in budget scarcity situations.

Best Practices

Program Implementation: Participation Process
• Review and understand product availability before establishing product eligibility. • Publish program application documents on the Internet. • Provide assistance in preparing and submitting program applications through outreach events and workshops and through online help tools. • Minimize documentation requirements. • Offer incentives – particularly to upstream market actors. • Provide AC contractors training on selling and proper installation practices. • Utilize electronic processing. • Try to maintain some availability of program funds throughout the program year.

- **Review and understand product availability before establishing product eligibility.** As equipment availability improves, efficiency standards can be made more stringent.

- **Publish program application documents on the Internet.** Although only California cited publishing application forms on the Internet, several utilities utilize the Internet to promote their programs. (See *NR1 – Non-residential Lighting Programs* for more examples.)

- **Provide assistance in preparing and submitting program applications through outreach events and workshops and through online help tools.** Enlist contractors and vendors help in preparing applications on behalf of the customer.

- **Minimize documentation requirements,** particularly those that require a new form for each portion of the participation process (recording the customer information, recording the installation, recording the program impacts, recording the incentive application, rolling up data into a report and invoice, etc.). Contractors will not participate aggressively if they incur significant costs in application development. Paperwork should be easy for contractors and customers

- **Offer incentives–particularly to upstream market actors.** Incentives can prompt dealers to promote high efficiency air conditioners and customers to consider the high efficiency alternative. A large number of installations are prompted by unit failures, frequently putting the decision-making process in a crisis mode. Upstream market actors are in the best position to influence a reasoned approach and encourage high efficiency equipment.

- **Provide AC contractors training on selling and proper installation practices.** The contractor typically has the last chance to convince a customer to make an energy efficient choice and to ensure proper installation. Sales and installation training helps move the market towards greater efficiency.

- **Utilize electronic processing.** Electronic application processing improves the program implementer's responsiveness and reduces administration cost. (See *NR1 – Non-residential Lighting Programs* for examples.)

- **Try to maintain some availability of program funds throughout most of the program year.** Maintaining funds throughout most of the program year gives trade allies the confidence that they can sell the benefits of participation without concern that their customers will make a decision to install a project based on the program only to find out that funds are unavailable. It also provides customers with the confidence that they can apply for the program at the appropriate point in their decision-making process, rather than feeling pressured to apply quickly simply to reserve funds.

3.6 PROGRAM IMPLEMENTATION: MARKETING AND OUTREACH

The six programs reviewed engaged in a variety of marketing and outreach efforts aimed at encouraging program participation. Most programs utilized traditional communication approaches such as utility bill inserts and newsletters. Utility field personnel also played a role

in customer outreach. The most frequently used communication channel, however, was the vendor and contractor community.

NEEP's 2002 Cool Choice program used "circuit riders" to market the program to distributors and dealers. There was also a broader marketing effort involving mailings to customers and contractors, presentations, association meetings, trade shows, and an Internet presence. Approximately three-fourths of the marketing budget, went to circuit riders and the remainder goes to broader marketing.

NEEP's program tried offering a stocking incentive to wholesalers/distributors to cover the difference in financing for energy efficient units. The incentive proved to be too little money and required too much explanation; the NEEP program managers advice against the practice.

Avista's 2001 Rooftop HVAC Maintenance program was marketed to customers via the dealer networks. Dealers both contacted their existing users and went door to door to solicit new customers. The program did not dictate how dealers presented the program to the customer. The program supplemented dealer outreach efforts with direct mail and brochures.

Marketing methods included direct mail, brochures, and seminars. Account executives contacted consumer and trade groups to directly market the service. Advertising continued until the targeted volume of participation was achieved. The most important marketing effort, however, was the dealer initiative, because the competition between dealers stimulated activity.

California's 2002 Express Efficiency program used direct mail targeted to specific economic development areas, rural areas and hard-to-reach customers. Informational pieces, available in English, Spanish, Korean, Chinese, and Vietnamese, educated customers on eligible equipment, the size of rebates and on procedures for requesting the rebate. IOUs also assisted small businesses to develop and tailor energy efficiency information to disseminate to their own constituents and stakeholders. Express Efficiency administrators emphasized community and faith-based organizations in their outreach efforts. Vendor marketing was another successful marketing and outreach practice for Express Efficiency.

The Los Angeles Department of Water and Power relied on vendors, personal relationships, and direct contact as the means of marketing and outreach. Since there are a relatively few number of large chiller replacements on an annual basis, even in Los Angeles, this was a more reasonable method of marketing than other methods that may broadcast to an inappropriate audience. In contrast, FPL occasionally produced television and radio advertising to increase customer awareness. This strategy can be effective since every commercial customer is part of FPL's target market. Nevertheless, FPL relied primarily on its field representative and contractors to market the program.

Glendale's 2001 Check Me! program was marketed first to local contractors, who then marketed directly to potential customers. Contractors' efforts were supplemented with bill inserts, brochures and door hangers. The customer directed messages helped spur contractor participation so they would not need to turn away inquiring customers. Finally, articles in Glendale Water and Power's "City Views" publication and in the L.A. Times helped encourage participation.

Best Practices

Marketing and Outreach
• Cooperate with contractors to get the message out. • Communicate with customers through multiple media. • Assemble and use information about the target consumer demographics. • Leverage marketing dollars through cooperative marketing efforts, sponsorship by manufacturers and through coordination with national or regional efforts to promote similar products. • Use the program's Web site to broadly inform the market and attract participation. • Keep energy efficiency service providers well informed about program features and changes through seminars, training sessions, trade shows, and annual meetings of key groups. • Conduct on-going training of account managers and other marketing staff to keep abreast of the latest efficiency technologies and practices.

- **Cooperate with contractors to get the message out.** The greater the number of sources recommending the same course of action, the more likely consumers will perceive and act upon the message. Contractors are the last experts with whom customers will communicate before their equipment decision is final.

- **Communicate with customers through multiple media.** Combine bill inserts, brochures, the Internet, 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.

- **Assemble and use information about the target consumer demographics.** The message should be tailored differently for clearly distinct audiences. Multilingual communications are important in some areas. It is also important to choose the correct media. Mass-market communication schemes are not suitable for large chiller projects, but may be for targeting customers with packaged rooftop units.

- **Leverage marketing dollars through cooperative marketing efforts, sponsorship by manufacturers and through coordination with national or regional efforts to promote similar products.** A regional commitment to high efficiency products can help manufacturers get onboard with producing, stocking and promoting high efficiency equipment. Manufacturer and distributor support will help both the salesperson and the customer agree on the benefits and economics of a properly installed high efficiency system.

- **Use the program's Web site to broadly inform the market and attract participation.** Because the large non-residential market is made up of a small population of well-informed customers and efficiency service providers, driving prospective participants to

a comprehensive program Web site is often effective without significant other investments in traditional advertising. This can also be a low-cost and effective way to match the timing of the message to the timing of the transaction – a critical component of a successful HVAC marketing effort.

- **Keep energy efficiency service providers well informed about program features and changes through seminars, training sessions, trade shows, and annual meetings of key groups.** To keep private sector marketing efforts effectives, it is important to provide outreach and offer training on both on-going program details and periodic program updates.

- **Conduct on-going training of account managers and other marketing staff to keep abreast of the latest efficiency technologies and practices.** Keeping up with the latest technical information is critical in the HVAC market, particularly when new standards cause major changes in product lines. The importance of properly installing and commissioning HVAC systems should be a central theme of program training and communication.

3.7 PROGRAM EVALUATION

Program evaluation activities varied among the six examined 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.

Evaluation of the NEEP 2002 Cool Choice program occurred at the utility level, although evaluation is not an ongoing, annual process. There has been a process evaluation completed by PA Consulting, and a marketing and baseline study conducted by Easton Consultants. It appears, however, that the NEEP approach to program planning and administration has just as significant program implementation benefits as regular process evaluations.

Avista performed an in-house analysis of its HVAC Maintenance program data one year after implementation. A random sample of projects was pulled, along with utility data. Weather normalized pre-tune up utility data was also compared the post data. Most cases met or exceeded expectations or could be explained by operational changes in the intervening time.

The California programs have been subjected to greater study than most of the other programs. Extensive annual impact evaluations were conducted from 1994-1998. More recent evaluations included a 1998 Market Effects Study, a 1999 baseline market study, and a 2002 comprehensive evaluation addressing process and impact program elements.

LA DWP has not performed an evaluation study of its 2002 Chiller Efficiency program. DWP's auditors did examine documentation procedures and made recommendations to simplify auditing procedures.

FPL has performed extensive impact, market and process evaluations of its Commercial and Industrial HVAC program on an annual basis for at least a decade. As a result, FPL has detailed program impact models and market penetration models to inform program design changes.

Glendale relied on data supplied by PEG for its evaluation effort. Evaluation data collected included system data and customer satisfaction information.

Best Practices

Program Implementation: Program Evaluation
• Periodically review and update market-level information about HVAC 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. • Perform market assessments routinely, though not necessarily annually. • Present actionable findings to program managers at the conclusion of study. • Conduct both process and impact evaluations routinely. • Include estimation of free-ridership and spillover.

- **Periodically review and update market-level information about HVAC distributor and contractor installation practices and consumer awareness of benefits associated with high efficiency, matched systems, proper sizing and proper installation practices.** Policy and market changes will affect the suitability of program design elements. Without periodic adjustments, program impacts and cost-effectiveness will diminish.

- **Periodically review and update algorithms for calculating project savings.** Regulatory, technology and other market changes will alter baseline efficiency assumptions; they also afford the opportunity to "raise the bar." Even if market aspects are unchanged, new insights to deriving savings algorithms might result in program improvements.

- **Perform market assessments routinely, though not necessarily annually.** Market assessments should occur when the market or program design change significantly.

- **Present actionable findings to program managers at the conclusion of study.** Presentations bring implementers into the feedback loop and encourage them to act on study recommendations.

- **Conduct both process and impact evaluations routinely.** HVAC programs and markets are very dynamic and require regular assessment in order for program managers and

policy makers to continuously improve them. They are also often the largest programs in an administrator's portfolio and hence require close monitoring.

- **Include estimation of free-ridership and spillover.** Although measuring free-ridership and spillover can be challenging, there is usually critically important knowledge gained about program effectiveness through these analyses. Free-ridership and spillover measurement often provide the most actionable and practically useful information in an evaluation. It is important, however, for parties to agree upfront on how results will be used, particularly with respect to any performance rewards or penalties for program administrators.

4. COMPARISON OF OUTCOMES

This section presents cost-effectiveness estimates obtained from the programs reviewed. Energy efficiency programs and portfolios are often designed with specific policy objectives in mind, and those objectives 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 market potential and 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; constantly changing objectives 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.[6]

- **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.

[6] 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.

This aspect also affects the relative cost of capacity versus energy savings since peak benefits are similar among climates, while energy benefits are not.

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

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

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

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

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

Exhibit NR2-7 displays program, incentive, and non-incentive dollars spent per kW, which offers an indication of the cost to market and administer. Incentive dollars per kW shows the overall average incentive amount per unit of estimated first-year impact. Information on the Total Resource Cost (TRC) test, the associated discount rate and the average measure life was not generally available, nor was the utility (program administrator) cost test information.

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.

Exhibit NR2-7
Program Effects

Element	NEEP Cool Choice[7]	Avista Rooftop HVAC Maintenance	CA Express Efficiency	LA DWP Chiller Efficiency	FPL C/I HVAC	GWP CheckMe!
Period Reviewed	2002	2001	2002	2003-04	2002	2001
Net to Gross Ratio	85%	1.0	0.96	NAV	NAV	NAV
FreeRidership Rate	15%	0%	NAV	NAV	NAV	NAV
Total Resource Cost/Societal Test	3.6	NAV	NAV	NAV	NAV	NAV
Average measure life (years)	18	NAV	NAV	NAV	NAV	NAV
Average measure life (hours)		NAV	NAV	NAV	NAV	7 (AC) 20 (ducts)
Net MWh (Annual)	597	13,000	2,785	7,174	NAV	NAV
Gross MWh	702	13,000	2,901	NAV	54,112	1,069
Net kW (Annual)	400	NAV	NAV	5,666	NAV	NAV
Gross kW (Annual)	400	NAV	NAV	NAV	20,395	358
Nominal Discount Rate	NAV	NAV	8%	NAV	NAV	NAV
Budget Per Impact						
Program Expenditures	$351,000	$1,750,000	NAV	$786,430	$5,434,000	$150,000
Incentive Expenditures	$201,000	NAV	$462,839	$686,430	$4,445,000	$68,000
Program $/first-year kWh saved	$0.50	NAV	NAV	$0.11	$0.10[8]	$0.14[9]
Incentive Dollars per kWh	$0.29	NAV	$0.17	$0.096	$0.082	$0.064
Non-Incentive Dollars per kWh	$0.21	NAV	NAV	$0.013	$0.018	$0.077
Program $/first-year kW saved	$825	NAV	NAV	$139	$266	$419
Incentive Dollars per kW	$474	NAV	NAV		$218	$190
Non-Incentive Dollars Spent per kW	$352	NAV	NAV	NAV	$48	$229

[7] NEEP Cool Choice data reflects values provided for Connecticut Light & Power only.

[8] "Dollars-per" values based on gross, not net, savings.

[9] ibid.

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APPENDIX NR2A – BRIEF INTRODUCTION TO THE NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

INTRODUCTION

This report presents results of a comparative analysis of non-residential HVAC 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

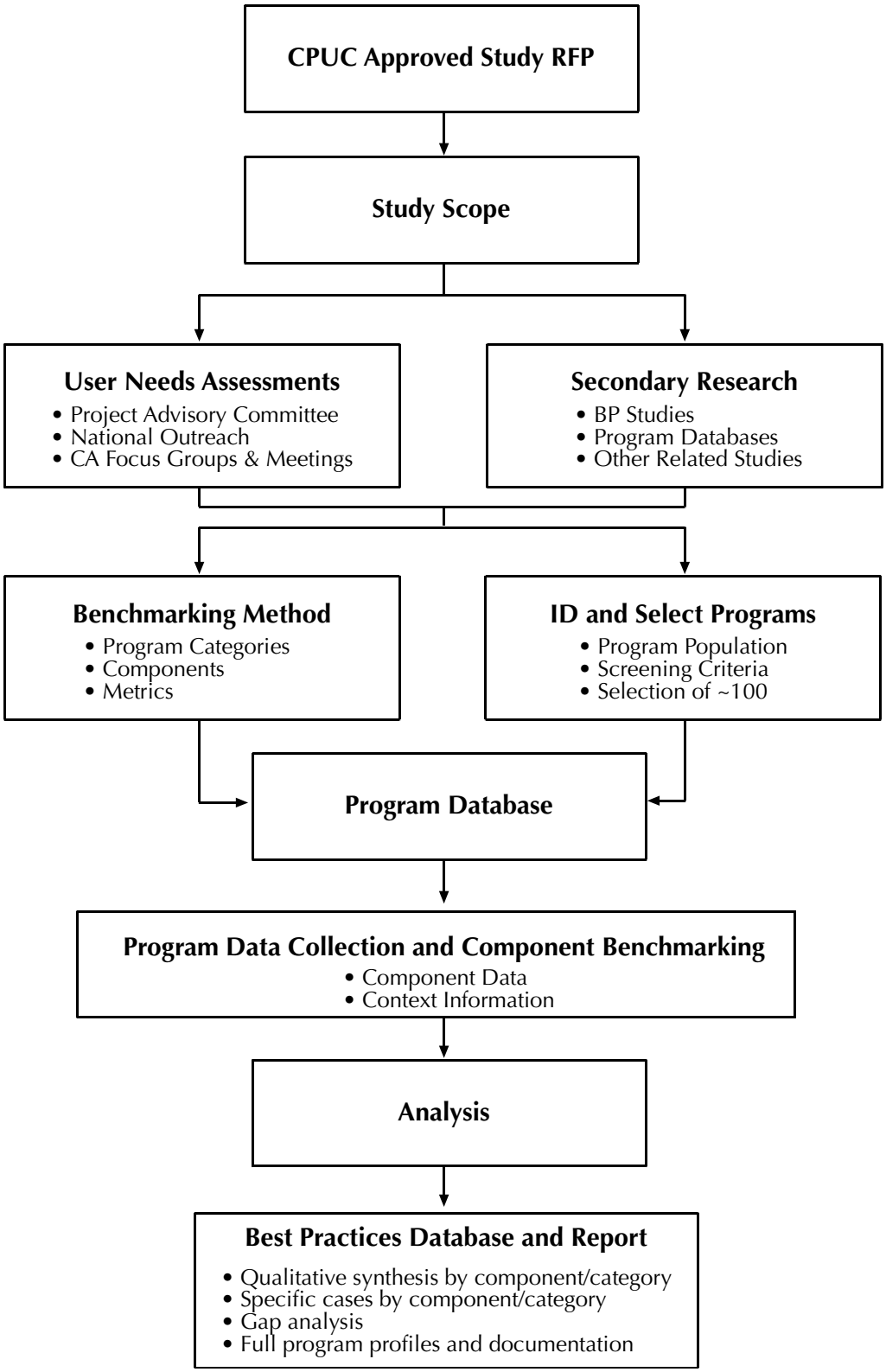
The overall goal of the Best Practices Study is to develop and implement a method to identify and communicate excellent energy efficiency program practices nationwide in order to enhance the design of such programs in California. In particular, program implementers supported through public goods funds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

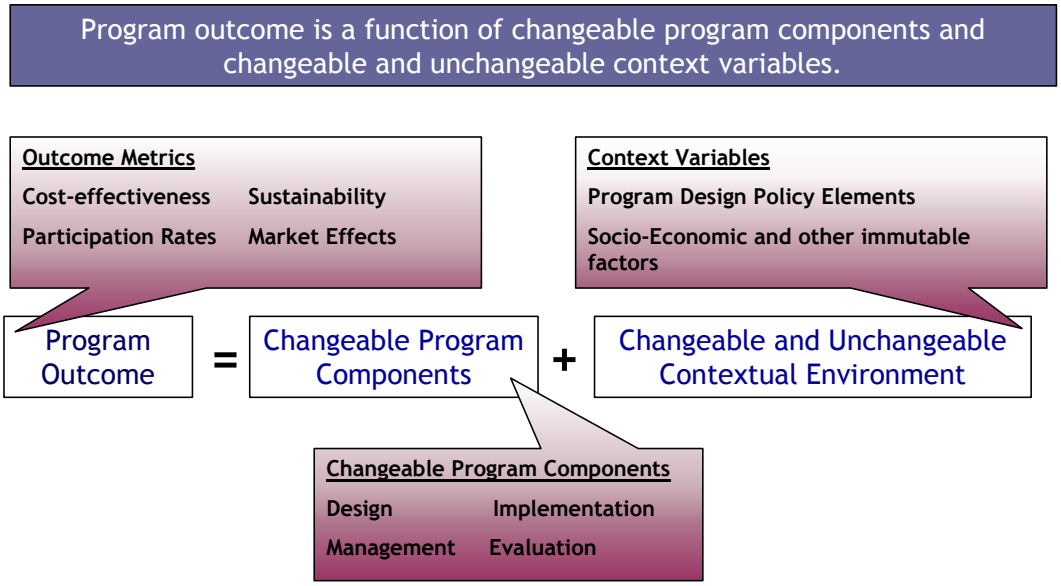
Key aspects of the Best Practices Study include a user needs assessment, secondary research, development of the benchmarking methods, identification and selection of programs to benchmark, development of the program database, data collection and program benchmarking, analysis, and preparation of the 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 NR2-8 below.

Exhibit NR2-8
Overview of Energy Efficiency Best Practices Study



As shown below in Exhibit NR2-9, 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 NR2-9
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 NR2-10 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., R1 Programs = Residential Lighting Programs reviewed for the Best Practices Study).

Exhibit NR2-10
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	Crosscutting		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 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.