QUANTUM CONSULTING

NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

VOLUME NR8 – NON-RESIDENTIAL NEW CONSTRUCTION BEST PRACTICES REPORT

Submitted to

California Best Practices Project Advisory Committee
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ES. EXECUTIVE SUMMARY FOR NON-RESIDENTIAL NEW CONSTRUCTION PROGRAM AREA (NR8)

ES.1 INTRODUCTION

This volume presents results of a comparative analysis of Non-residential New Construction programs included in the National Energy Efficiency Best Practices Study. The overall study objectives, scope, and methodology are briefly outlined in Appendix NR8A 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 new construction programs for this report. The NR8 Programs are listed in Exhibit NR8-E1 below and presented in the body of this report.

Exhibit NR8-E1
NR8 Programs: Non-residential New Construction Programs Reviewed For NR8 Study

Program Name	Implementer/s	Abbreviation for NR8 Report
Energy Conscious Construction	Northeast Utilities	NU ECC
Energy Design Assistance	Xcel	Xcel EDA
Design 2000 Plus	National Grid	NGRID D2000+
Savings By Design	Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and Southern California Gas Company	CA SBD
Construction Solutions	NStar	NSTAR CS
Commercial & Industrial New Construction Program	Hawaiian Electric Company	HECO C&I NCP

ES.2 KEY CATEGORY THEMES

We identified three components that seem to drive the success of programs in non-residential new construction. These are: integrated design and design assistance, relationship building, and long-term commitment to the sector.

An early and active role in project design is crucial. Most programs reviewed for this study promoted integrated design in some fashion. Integrated design adds value because cost-effective energy savings opportunities decline as the project progresses through the various design stages. For example, opportunities to capture benefits from daylighting, natural ventilation, and passive solar design are tied to siting decisions made during schematic design phase. Incorporating energy efficiency into a project that has completed design often requires costly and time-consuming design changes. Once an energy-efficient element is incorporated into the project design, the challenge becomes to keep the element in place through subsequent design changes and value engineering.

Relationship Building enhances trust and communication between market actors and program implementers. Making a long-term commitment to be active in the non-residential new construction market and build relationships with market actors is critical to success, particularly in the face of program changes. Good relationships with architects and engineers are particularly important because these design professionals provide the best opportunity to identify and get involved with projects early in the design process.

A long term commitment to the sector is beneficial. Commercial and industrial new construction programs often require three years or more from project initiation to completion. Program managers must be able to assure a degree of stability in program funding levels and project requirements over a similar time horizon in order for participation to be a viable option.

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 all relevant secondary sources such as program filings and evaluations. In Exhibit NR8-E2 we present the list of best practices developed from our analysis of non-residential new construction programs. In Exhibit NR8-E3 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 California's Statewide Savings By Design Program is in progress and will be published when complete in a separate document.

Exhibit NR8-E2
Summary List of Best Practices for Non-residential New Construction Programs

Program Theory and Design
• Have a well-articulated theory or program logic • Link program tactics to the stated theory • Plan thoroughly • Involve multiple stakeholders • Build feedback loops into the program design • Maintain program design flexibility • Emphasize integrated design • Provide a systems- or component-based participation track • Understand local market conditions • Offer financial incentives to both the project owner and the design team • Stay abreast and ahead of future standards • Scrupulously protect program credibility; do not over-promise results
Program Management: Project Management
• Make sure program has upper management's buy-in and funding • Put the process plan in writing • Keep management teams small • Maintain active communication with implementation team and stakeholders • Maintain flexibility to respond to changing market conditions and unforeseen eventualities • Assemble the most technically proficient implementation team possible • Provide staff with good training • Reward high performing staff • Make sure that program managers and staff at all levels have decision-making authority commensurate with their responsibilities
Program Management: Reporting and Tracking
• Define and identify the key information needed to track and report early in the program development process • Minimize duplicative data entry • Develop accurate algorithms and assumptions on which to base estimates of savings • Design databases to be scalable to accommodate changes on program scope • Use the Internet to facilitate data entry and reporting for private-sector market actors • Automate routine functions such as monthly reports • Build in rigorous quality control screens for data entry • Carefully document the tracking system
Program Management: Quality Control and Verification
• At the project outset, clearly identify qualifying measures to be included in the project, along with their expected impacts • Clearly define post-inspection policies and procedures • Track every project at every phase • Make sure that project inspectors are equipped with the training and experience required for the task • For complex projects, especially those involving controls, consider requiring performance verification • Tie verification to full building occupancy

Exhibit NR8-E2
Summary List of Best Practices for Non-residential New Construction Programs (Continued)

Program Implementation: Participation Process
• Get involved early in the project design process • Structure participation requirements to discourage the design team from cutting energy efficiency features during value engineering • Maintain a flexible participation strategy • Provide project proponents with guidance about participation options • To facilitate participation from the customer's perspective, work with project engineers to obtain design parameters and related technical information • Obtain HVAC and lighting calculation inputs directly from project drawings and plans • For projects involving DOE2 simulations, establish definitive base case and final scenarios. • If incentives are performance-based, then incorporate other disincentives to inflating savings via exaggerated operating hour estimates, etc. • If incentives are based on incremental costs, then make sure program managers have access to solid, up-to-date information regarding industry average costs for typical measures • Develop a baseline document that provides guidelines for determining the appropriate benchmark for energy impact and incremental cost calculations • In the field, avoid over-committing to a project before the design parameters are known
Program Implementation: Marketing and Outreach
• Avoid mass marketing techniques such as direct mailings; newspaper, radio, and TV ads; and telemarketing • Leverage trade ally opportunities, trade association trainings, annual meetings, etc. • Sell customer benefits first, then energy efficiency; know your customers and their needs • Keep benefits quantifiable in terms of economics. Promote a life-cycle cost perspective of benefits • Understand building technologies and construction practices, along with their customer benefits (energy and non-energy)
Program Evaluation
• Evaluation metrics must be in-line with program goals • Support program review and assessment at the most comprehensive level possible • Select an evaluator who has a detailed understanding of the market context in which a program operates • Market level information about construction practices and energy efficiency measure adoption should be periodically reviewed and updated • Algorithms for calculating project savings should be periodically reviewed and updated • For process evaluations, build in ongoing evaluation activities to provide timely, fresh data • Conduct regular impact evaluations • Focus cost-benefit analyses on cohorts of completed projects rather than cohorts of initiated projects. • Conduct periodic baseline studies • Measure both free ridership and spillover effects • Make evaluation recommendations seriously and incorporate lessons learned into the program

Exhibit NR8-E3
Summary of Best Practices Rationales for Non-residential New Construction Programs

Best Practice	Rationale
Program Theory and Design	
Have a well-articulated theory or program logic	Even a relatively simple statement of program logic can reveal gaps in program focus or effort and assure that everyone involved knows what the program seeks to accomplish and why.
Link program tactics to the stated theory	Articulating a program theory and structuring program tactics that are in line with the program theory assures that programs are fundable, feasible, and capable of being evaluated.
Plan thoroughly	Leverage prior experience, both locally and around the country. A detailed, well thought-out plan is easier to present and explain to potential critics.
Involve multiple stakeholders	Involve stakeholders, including those who should theoretically benefit from the program, trade allies whose cooperation will drive program success, and regulators / policy makers who must understand and approve the program design. Including multiple stakeholders will bolster the plan's credibility and produce a plan that reflects local market conditions and works from the perspective of a range of sometimes divergent viewpoints. A well thought-out plan will contribute to smooth program implementation. Get stakeholder buy-in through communication and collaboration. Buy-in from architecture and engineering (A/E) professionals is particularly important since, in many cases, they will be the primary conduit for identifying projects in the schematic design stage.
Build feedback loops into the program design	To assure that stakeholders continue to provide input throughout program implementation.
Maintain program design flexibility	To respond to changing market conditions and address unforeseen challenges throughout program implementation.
Emphasize integrated design	Especially for large, complex projects. Integrated design is the surest way to capture all cost-effective energy efficiency opportunities. Design assistance based on integrated design is particularly valuable as a market transformation strategy because it cultivates private-sector design capabilities. Program managers may wish to explore strategies for harnessing the expanding interest in integrated design associated with USGBC's LEED™ system.
Provide a systems- or component-based participation track	A systems-based approach may be more appropriate for smaller projects that lack complex design challenges and for projects that are already well along in the design process. It also provides an avenue for a skeptical participant to explore program resources and benefits without committing his or her project design team to an integrated design approach.

Best Practice	Rationale
Understand local market conditions	A solid understanding of local conditions is vital for recognizing which lessons from other areas transfer to the local market and which ones do not. As much as possible, justify program design with objective baseline market research to bolster design credibility with diverse stakeholders.
Offer financial incentives to both the project owner and the design team	Beyond buying down the cost of energy efficiency, incentives help establish the program's credibility in the minds of private-sector market actors who may be reluctant to be the first to try something new. Design team incentives help allay concerns about the extra effort that integrated design may entail. Payments can be tied to energy efficiency enhancements incorporated in the construction project to discourage the design team from eliminating enhancements during value engineering.
Stay abreast and ahead of future standards	Good program planning requires that program managers understand the implications of future changes in standards for program baseline, cost effectiveness, and participation.
Scrupulously protect program credibility; do not over-promise results	Program credibility as an objective, trustworthy, and knowledgeable information source is crucial. Optimistic promises may attract more interest early on but they set the stage for disappointment later. Be prepared to justify all claimed program benefits with objective building science.
Program Management: Project Management	
Make sure program has upper management's buy-in and funding	Non-residential new construction projects have multi-year planning and construction horizons, which means that programs require several years to generate tangible impacts. Upper management must embark on the process with patience, reasonable expectations, and a commitment to fund the entire start-up phase.
Put the process plan in writing	Write down all-important decisions that interpret plan elements. A written plan is more likely to be a well thought-out plan and is easier to disseminate to the various affected stakeholders.
Keep management teams small	Small teams are necessary to maintain close coordination, facilitate good communication, and increase the likelihood of reaching consensus (when multiple entities are involved in decision making).
Maintain active communication with implementation team and stakeholders	Good two-way communication facilitates program flexibility within a structured framework.
Maintain flexibility to respond to changing market conditions and unforeseen eventualities	Clear-cut accountability and good communication with regulators and stakeholders may mitigate tendencies to impose regulatory requirements that limit flexibility.
Assemble the most technically proficient implementation team possible	Whether the program relies on in-house staff or contractors to provide design assistance and technical support, make sure service providers are experienced, knowledgeable, and able to understand project proponents' concerns.

Best Practice	Rationale
Provide staff with good training	Match the training to their skill needs. Program services will only be as good as the people who deliver them. Human resources are as important to program success as financial resources.
Reward high performing staff	Link staff performance evaluations to tangible measures, which are known upfront and developed together. Staff will perform better when they clearly understand what is expected of them and they agree that the expectations are reasonable. Good staff management minimizes turnover and promotes program stability.
Make sure that program managers and staff at all levels have decision-making authority commensurate with their responsibilities	A good balance between authority and responsibilities is a prerequisite for performance expectations that are perceived as reasonable. Delegate responsibility and authority to avoid institutionalized bottlenecks.
Program Management: Reporting and Tracking	
Define and identify the key information needed to track and report early in the program development process	Clearly articulate the data requirements needed to measure success. Identify all the stakeholders and their information needs and design accordingly.
Minimize duplicative data entry	Link databases to exchange information dynamically. This is especially important if the program uses separate tracking systems for program participation, inspection scheduling and coordination, and customer billing.
Develop accurate algorithms and assumptions on which to base estimates of savings	Use tracking system results to periodically review deemed savings estimates and bring them in line with actual building performance. This exercise will help set reasonable expectations and avoid the temptation to oversell program benefits.
Design databases to be scalable to accommodate changes on program scope	Doing so will enhance the program's overall flexibility and ability to respond to unforeseen market conditions.
Use the Internet to facilitate data entry and reporting for private-sector market actors	Internet access is now widespread and electronic data transfer and sharing can greatly enhance the quality and cost-effectiveness of information management. Internet-based systems can help minimize duplicative data entry and storage and automate many routine quality-control steps.
Automate routine functions such as monthly reports	Doing so provides an opportunity to build in quality control checks and frees staff time for more strategically important tasks.
Build in rigorous quality control screens for data entry	Program the tracking software to reject inconsistent, inaccurate, or incomplete data to minimize the extent of subsequent data cleaning and enhance the accuracy and credibility of reported results.
Carefully document the tracking system	Including database structure, data field definitions and screening criteria, and data entry and analysis procedures. Good documentation will help mitigate problems stemming from staff turnover, especially when the system must serve a variety of users with varying computer skill levels.

Best Practice	Rationale
Program Management: Quality Control and Verification	
At the project outset, clearly identify qualifying measures to be included in the project, along with their expected impacts	Program managers and participants should agree upfront which project elements qualify for a program incentive and how subsequent modification of those elements could affect the incentive amount.
Clearly define post-inspection policies and procedures	Policies and procedures should address issues such as when and how to sample, how to address data gaps, etc.
Track every project at every phase	Construction projects are subject to a variety of forces that modify project schedules and design. Careful project tracking is the only way to assess the implications of those modifications for future program. Good tracking is a prerequisite for good budget management.
Make sure that project inspectors are equipped with the training and experience required for the task	Be prepared to bring in outside consultants to assist with particularly complicated projects.
For complex projects, especially those involving controls, consider requiring performance verification	Ideally, commissioning should be required, at least for more complex projects. At a minimum, system performance verification provides assurance that incentive payments are tied to real savings and that measure installation and startup operation conforms to design intent.
Tie verification to full building occupancy	An empty building should get no commissioning and no payment. Partial occupancy should trigger a reassessment of operational inputs to savings estimates. Verification of measures such as chiller optimization, VAVs, energy management systems, and lighting controls should ensure that systems are optimized for actual occupancy and loads.
Program Implementation: Participation Process	
Get involved early in the project design process	The further along in the design process, the more limited the opportunities to incorporate energy efficiency strategies without incurring change orders and other project disruptions.
Structure participation requirements to discourage the design team from cutting energy efficiency features during value engineering	Design incentives should translate into tangible design improvements and energy savings.
Maintain a flexible participation strategy	The whole building process is more time-consuming with the client. A customized or systems approach accommodates projects that require a degree of design flexibility but not the level of planning that the whole building process entails. A prescriptive approach enables project designers to incorporate pre-screened measures that fit within the project's design specifications.

Best Practice	Rationale
Provide project proponents with guidance about participation options	Multiple participation options enable a program to accommodate a greater variety of construction projects but they add to the complexity of participant decision making. Couple multiple participation options with structured guidance to minimize participation barriers.
To facilitate participation from the customer's perspective, work with project engineers to obtain design parameters and related technical information	In this way, customer participation requirements can be reduced to just signing the contract and cashing the incentive check.
Obtain HVAC and lighting calculation inputs directly from project drawings and plans	In order to get the most accurate possible numbers.
If incentives are performance-based, then incorporate other disincentives to inflate savings via exaggerated operating hour estimates, etc.	All incentive structures should be critically reviewed to minimize gaming opportunities. Performance-based structures are particularly vulnerable due to the variety and complexity of input assumptions required to determine expected performance.
For projects involving DOE2 simulations, establish definitive base case and final scenarios.	To support incentive calculations, as-built measure verification, and program evaluation, project folders should clearly document the final DOE2 simulations used to determine base-case and final conditions.
If incentives are based on incremental costs, then make sure program managers have access to solid, up-to-date information regarding industry average costs for typical measures	Lack of such information creates opportunities for project proponents to game the system.
Develop a baseline document that provides guidelines for determining the appropriate benchmark for energy impact and incremental cost calculations	Establishment of appropriate baselines is a perennial challenge for new construction programs. Creation of a baseline document helps program staff and participants to arrive at a common understanding of expected project impacts.
In the field, avoid over-committing to a project before the design parameters are known	A solid understanding of project design parameters facilitates targeted deployment of program resources and minimization of free ridership.
Program Implementation: Marketing and Outreach	
Avoid mass marketing techniques such as direct mailings; newspaper, radio, and TV ads; and telemarketing	Mass-market techniques are rarely effective in identifying individual decision makers involved with new construction projects; key decision makers in this market require more personalized outreach to be persuaded to participate.
Leverage trade ally opportunities, trade association trainings, annual meetings, etc.	Trade ally relationships will generally be more effective than mass marketing at generating project leads. Relationships with architecture and engineering (A/E) professionals is particularly important since, in many cases, they will be the primary conduit for identifying projects in the schematic design stage. Local government planning and permitting departments may also be helpful allies.

Best Practice	Rationale
Sell customer benefits first, then energy efficiency; know your customers and their needs	Energy efficiency messages rarely resonate with the customer. Economic benefits tend to be more persuasive. To close the deal, the program representative must understand the customer's needs and barriers and be able to articulate the benefits of program participation in language the customer understands and finds compelling.
Keep benefits quantifiable in terms of economics. Promote a life-cycle cost perspective of benefits	To the extent possible, quantify health and productivity benefits. Project proponents often lack key information regarding the life-cycle cost implications of their design alternatives. Clear presentation of this information can be persuasive.
Understand building technologies and construction practices, along with their customer benefits (energy and non-energy)	Provide formal training for program marketing staff throughout the year. Hold meetings with manufacturers and vendors to better understand the technologies they offer. Solid technical expertise is a prerequisite for understanding customer needs and gaining customer confidence.
Program Evaluation	
Evaluation metrics must be in line with program goals	One evaluation objective should be to assess program progress toward achieving predetermined goals. The only way to accomplish this objective is to establish metrics that measure that progress.
Support program review and assessment at the most comprehensive level possible	For some programs, this will mean a comprehensive market assessment and impact evaluation, for others it may mean a program review document created in-house. To the extent possible, market transformation programs should measure program impacts. Likewise, resource acquisition programs should look beyond simple participant/non-participant comparisons. More comprehensive results will better permit program managers to gauge program performance over time.
Select an evaluator who has a detailed understanding of the market context in which a program operates	Be sure the evaluation scope provides sufficient interaction between evaluation and implementation staff to give the evaluator a clear understanding of program dynamics. Clear communication channels are essential.
Market level information about construction practices and energy efficiency measure adoption should be periodically reviewed and updated	The degree of sophistication of these market baseline studies will vary, depending on program and market factors. For example, a program operating in a large, highly fragmented market may require a full-scale study to obtain an accurate picture of market conditions; whereas a program in a small or highly concentrated market may be able to compile a reasonable picture of market conditions through its routine interactions with key market players. Keeping abreast of program and measure market penetration is critical.
Algorithms for calculating project savings should be periodically reviewed and updated	The objective should be to maintain a set of savings algorithms that are reasonably calibrated with real-world building performance. Depending on the level of precision required and available resources, calibration can involve simply re-estimating key engineering parameters or conducting building simulation and billing analyses.

Best Practice	Rationale
For process evaluations, build in ongoing evaluation activities to provide timely, fresh data	Plan for short time lags between participation and customer interviews to minimize revisionist histories and memory loss. Do not rely solely on impact evaluations to provide recommendations for program improvements several years after the fact.
Conduct regular impact evaluations	Evaluations should verify program cost effectiveness and ensure that as-built engineering estimates of savings are properly calibrated to actual impacts.
Focus cost-benefit analyses on cohorts of completed projects rather than cohorts of initiated projects.	The focus on projects initiated in a particular program year entails long delays until all initiated projects are completed and their full costs and benefits known. Implementing this shift requires a methodology for disaggregating program costs and assigning them to specific projects.
Conduct periodic baseline studies	Studies should update incremental cost information, cull out measures that contribute to free ridership due to widespread market adoption, and refocus program on measures and practices that remain cost effective, given changes in the program baseline.
Measure both free ridership and spillover effects	Despite the inherent difficulty of assessing free ridership and spillover, an understanding of both dynamics is necessary to maximize program effectiveness.
Take evaluation recommendations seriously and incorporate lessons learned into the program	Evaluations should be used to improve program performance as well as satisfy regulatory reporting requirements.

1. OVERVIEW OF REVIEWED PROGRAMS

The Best Practices research team reviewed six non-residential new construction programs for this report, all of which seek to capture time-dependent opportunities in non-residential new construction and renovation projects. A key component of this focus is integrated design. Programs typically took a whole building approach or blended a whole building and systems approach to energy efficiency. Key systems components targeted include lighting, HVAC, and shell improvements. There was less focus on refrigeration, motors, and process improvements, as program sponsors typically targeted those end uses through separate initiatives.

The six programs covered in this best practice study are introduced below:

- **Energy Conscious Construction** is implemented by Northeast Utilities throughout its service territory in Connecticut, New Hampshire, and Massachusetts. The program primarily targets mechanical engineers, equipment distributors, and HVAC contractors for commercial and industrial new construction projects and major renovations projects of existing buildings. The program offers a prescriptive track for simple rooftop HVAC, lighting, and motors projects. A custom track serves more comprehensive projects.

- **Energy Design Assistance,** offered by Xcel, targets new construction and major renovation projects. The program goal is to improve the energy efficiency of new construction projects by encouraging the design team to implement an integrated package of energy efficient strategies. The target markets for the program are commercial customers and small business customers, along with A/E firms. The program primarily targets big box retail, public government facilities, grocery stores, health-care, education and institutional customers. The program offers three levels of support, depending on project size. For projects over 50 thousand square feet, the program offers custom consulting. For projects between 24 and 50 thousand square feet, the program offers plan review. Smaller projects get the standard offering. The program covers multiple HVAC, lighting, and building envelope measures. The program also addresses industrial process motors and variable speed drives but does not address refrigeration, nor other industrial applications.

- **Design 2000 Plus** is a National Grid program to provide financial incentives and technical assistance to developers, customers, and design professionals to encourage the use of design features and electrical equipment that optimize energy efficiency in their projects. The target market is commercial, governmental, and industrial "time-dependent opportunities", defined as new construction, expansion of existing building, renovation of existing building, change in use or function of the building space, new equipment for a new process or expanded operation, replacement of failed equipment, or planned replacement of equipment. Virtually all market events except equipment retrofits are addressed. The program provides an array of services, including technical consulting services, equipment incentives, design incentives, commissioning services, ballast recycling, and financing.

- **Savings By Design** is implemented by the four largest investor-owned utilities in California: Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and Southern California Gas Company. The target market for the program is commercial, industrial, and agricultural new construction and renovation/remodel projects. The program promotes integrated design and seeks to influence projects at the programmatic or schematic design phase. It encourages early design involvement by offering building owners and their design teams a wide range of services including education, design assistance, owner incentives, and design team incentives. All end uses are considered. Participants can opt for either a Whole Building or Systems approach. The program also offers a wide range of publications, software tools, and trainings through Energy Design Resources.

- **Construction Solutions,** NStar's non-residential umbrella program, replaces the former "C&I New Construction" program and focuses on time-dependent opportunities (essentially, everything but retrofit). In 2003 this program was divided into three distinct tracks: New Construction, Equipment Replacement, and Municipal Buildings.

  This program encourages customers, developers, design professionals and equipment vendors to select high efficiency equipment and promotes more energy efficient designs for buildings and electrical and mechanical systems. The program also offers incentives to encourage the installation of energy-efficient replacement equipment when existing systems fail during operation or at the time of purchasing new equipment.

- **Commercial & Industrial New Construction Program,** implemented by Hawaiian Electric Company, encourages developers of C&I facilities to install energy-efficient equipment at the time of construction. Accordingly, new construction participants are offered direct cash incentives for energy conservation measures that are not normally implemented. Design assistance is also offered to building designers as a program marketing and delivery mechanism. The purpose of design assistance is to influence customers during the design phase of new construction projects by providing funding for additional engineering studies, either by the customer's design team or by a third party engineer. To effectively target the new construction market, utility representatives take advantage of existing contacts with builders, architects, and engineers in an attempt to become more involved early in the design phase.

A few summary characteristics of each program are provided in Exhibit NR8-1. Additional data and program characteristics are summarized in the remainder of this chapter and in the individual program profiles available on the Best Practices study website. Readers will note that not all data fields are complete. Detailed interviews were conducted with program managers representing each of the programs included in our analysis. As part of the interviews, the same data elements were requested for each of the programs. 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. Another goal was to obtain ex-post data on actual program expenditures and accomplishments; however, in some cases budgeted and planned accomplishments were all that were available at the time of this writing. Issues, limitations, and recommendations

associated with data availability and inconsistencies are discussed in detail in a separate methodology volume of this Best Practices Study.

Exhibit NR8-1
Non-residential New Construction Programs

	CA SBD	HECO C&I NCP	NGRID D2000+	NSTAR CS	NU ECC	Xcel EDA
Period Reviewed	2002	1999	2002	2001	2002	2002
Context	Statewide program since 2002; builds on 12+ years of utility programs	Mature program with plans to extend funding another 5 years	Mature program with plans to extend funding through 2007	Mature program with plans to extend funding through 2007	Program initiated in 1989. Program spans parts of two states and two regulatory agencies	Mature program. Increasingly stringent building standards may impact program goals and funding
Program Budget ($000)	22,604	935	13,916	7,926	7,435	3,435
Total Incentives Paid ($000)	13,469	631	8,907	5,209	5,937	1,987
MWh achieved	82,697	5,583.6	31,804	14,230	33,365	63,093
KW achieved	18,600	821	6,429	1,710	NAV	19,100
Unique Participants	576	NAV	705	138	253	138

2. CONTEXT

2.1 POLICY ENVIRONMENT

A hallmark of non-residential new construction programs is program stability and continuity. The programs routinely deal with projects with multi-year planning and construction horizons. From the participant's perspective, stability in program design, participation requirements, and incentive levels is critical for their decision-making process. From our limited sample, it appears that the message of continuity and stability has gotten through to upper management and regulators. Program managers across the board spoke of stable funding levels, stable program designs, and planning horizons ranging from two to five years. Official policies related to market transformation versus resource acquisition vary but, in practice, all programs incorporate elements of both.

California program managers described the biggest changes in policy environment. In 2001, in response to the state's energy crisis, the California Public Utilities Commission shifted its policy objective from market transformation to resource acquisition. It also instructed the four investor-owned utilities to merge their programs into a single statewide program. At the same time, the California Energy Commission undertook an emergency mid-cycle revision to the state building standards, which dramatically altered program baseline, incentive levels, and cost effectiveness.

2.2 PROGRAM STRATEGY AND GOALS

The programs the research team reviewed contain mixtures of resource acquisition and market transformation strategies. All of the programs have market transformation components, though not all define their programs as using market transformation strategies. Programs generally agree that influence at the earliest stages of project design is essential for maximizing the opportunities for cost-effective energy efficiency without disrupting the project schedule and generating change orders. There is also widespread agreement that building shell, lighting, mechanical systems are more efficient when designed collaboratively rather than sequentially.

The major barriers identified by these program contacts and the activities that may help to overcome them are described in Exhibit NR8-2.

Exhibit NR8-2
Barriers and Related Activities

Identified Barrier	Activity
Information and Search Costs	Provide design assistance, training, other information tools.
Asymmetric information and opportunism	Provide design and technical assistance via program staff who are perceived as objective, neutral, and knowledgeable, hence trustworthy.
Split incentives	Provide financial incentives to cover incremental costs of more efficient equipment and design strategies; provide design incentives to the design team; make the business case to building owners for energy efficiency as an investment with competitive returns.
Hassle or transaction costs	Influence the design team early in the process to avoid project redesigns, other program related delays; train A/E firms to prepare the bulk of project documentation on the project owner's behalf.
Performance uncertainties	Provide design assistance, training, technology demonstrations, other information tools.
Product or service unavailability	Train professional service providers; work with product manufacturers and distributors to increase product availability; reach out to projects that private sector design firms and ESCOs would pass up.
Bounded rationality	Provide integrated design assistance, strategies, information, and tools that allow market actors at all levels to accurately evaluate, understand, and size their projects.
High Costs	Provide financial incentives to cover incremental costs of more efficient equipment and design strategies; train A/E firms to perform life-cycle cost analysis.
Access to financing	Equipment leasing; project financing.
Hidden Costs	Provide training and analysis tools to assess life-cycle cost implications related to maintenance, comfort, equipment replacement costs, environmental quality, etc.
Organizational Practices and Customs	Training.

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

The six programs reviewed operate within a range of policy contexts spanning both market transformation and resource acquisition. In the case of California's program, the program was initially designed within a market transformation policy framework and then carried over to a resource acquisition framework when California shifted its policy in response to the energy crisis of 2001.

Despite the range of formal policy structures, actual program designs displayed remarkable uniformity. All programs included financial incentives, which tend to be associated with resource acquisition approaches. The one program manager who reported personal experience with s non-residential new construction information-only program called the program a dismal failure. Nevertheless, all programs also emphasized training and design assistance, consistent with market transformation strategies in that they influence standard industry practices and generate spillover benefits.

The importance of tailoring program design to local conditions was illustrated by the experience of NSTAR, which initially licensed its program from NGRID. The program then had to be redesigned to fit within NSTAR's account management system and incentive levels had to be recalculated to reflect market conditions in NSTAR's service territory.

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

- Most programs emphasized whole building performance and integrated design, as opposed to a narrower measure or end use focus. Several programs have found the U. S. Green Building Council's "Leadership in Energy and Environmental Design" (LEED™) system to be an effective tool for promoting a more integrated design approach.

- Programs emphasized a collaborative partnership approach to builder relationships. In particular, program staff actively participated in project design meetings as a way of facilitating the integrated design process, understanding the project proponent's needs, and tailoring recommendations to address them.

- Programs also emphasized collaborative or integrated design approach. Under this approach, the project architect, general contractor, mechanical engineer, and other key contractors work together as a collaborative team, starting at the initial design phase and continuing through construction.

- Program designs were largely empirical. Designers drew heavily from previous experience (both their own and others) and used an iterative approach to determine intervention strategies that would be most effective in their market. In most cases, the same program staff were responsible for design and implementation.

- Programs used financial incentives to overcome builder hesitation about program participation in general and integrated design in particular. Over time, as builders have learned to appreciate the benefits of program participation and integrated design, programs have been able to reduce subsidies.

- Programs that emphasized integrated design generally relied heavily on A/E firms to help them identify project leads and get involved with the project during the earliest design phases.

Best Practices

Program Theory and Design
• Have a well-articulated theory or program logic. • Link program tactics to the stated theory. • Plan thoroughly. • Involve multiple stakeholders. • Build feedback loops into the program design. • Maintain program design flexibility. • Emphasize integrated design. • Provide a systems- or component-based participation track. • Understand local market conditions. • Offer financial incentives to both the project owner and the design team. • Stay abreast and ahead of future standards. • Scrupulously protect program credibility; do not over-promise results.

Best program design practices for non-residential new construction programs include the following:

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

- **Link program tactics to the stated theory.** Articulating a program theory and structuring program tactics that are in line with the program theory assures that programs are fundable, feasible, and capable of being evaluated.

- **Plan thoroughly.** Leverage prior experience, both locally and around the country. A detailed, well thought-out plan is easier to present and explain to potential critics.

- **Involve multiple stakeholders**, including stakeholders who should theoretically benefit from the program, trade allies whose cooperation will drive program success, and regulators / policy makers who must understand and approve the program design. Including multiple stakeholders will bolster the plan's credibility and produce a plan that reflects local market conditions and works from the perspective of a range of sometimes divergent viewpoints. A well thought-out plan will contribute to smooth program implementation. Get stakeholder buy-in through communication and collaboration. Buy-in from architecture and engineering (A/E) professionals is particularly important since, in many cases, they will be the primary conduit for identifying projects in the schematic design stage.

- **Build feedback loops into the program design** to assure that stakeholders continue to provide input throughout program implementation.

- **Maintain program design flexibility** to respond to changing market conditions and address unforeseen challenges throughout program implementation.

- **Emphasize integrated design**, especially for large, complex projects. Integrated design is the surest way to capture all cost-effective energy efficiency opportunities. Design assistance based on integrated design is particularly valuable as a market transformation strategy because it cultivates private-sector design capabilities. Program managers may wish to explore strategies for harnessing the expanding interest in integrated design associated withU. S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED™) system.

- **Provide a systems- or component-based participation track.** A systems-based approach may be more appropriate for smaller projects that lack complex design challenges and for projects that are already well along in the design process. It also provides an avenue for a skeptical participant to explore program resources and benefits without committing his or her project design team to an integrated design approach.

- **Understand local market conditions.** A solid understanding of local conditions is vital for recognizing which lessons from other areas transfer to the local market and which ones do not. As much as possible, justify program design with objective baseline market research to bolster design credibility with diverse stakeholders.

- **Offer financial incentives to both the project owner and the design team.** Beyond buying down the cost of energy efficiency, incentives help establish the program's credibility in the minds of private-sector market actors who may be reluctant to be the first to try something new. Design team incentives help allay concerns about the extra effort that integrated design may entail. Payments can be tied to energy efficiency

enhancements incorporated in the construction project to discourage the design team from eliminating enhancements during value engineering.

- **Stay abreast and ahead of future standards.** Good program planning requires that program managers understand the implications of future changes in standards for program baseline, cost effectiveness, and participation.

- **Scrupulously protect program credibility; do not over-promise results.** Program credibility as an objective, trustworthy, and knowledgeable information source is crucial. Optimistic promises may attract more interest early on but they set the stage for disappointment later. Be prepared to justify all claimed program benefits with objective building science.

3.2 PROGRAM MANAGEMENT

All six programs are managed by utility staff, with two programs structured as collaborative efforts between multiple utilities. Broadly speaking, the programs all follow a similar program management structure, with in-house staff in a lead role, supported by contractors and consultants who add specialized technical expertise.

Several respondents stressed the importance of communication in successful program management. One respondent in particular emphasized the role of communication in making the Policies and Procedures a document that was actively consulted and adhered to rather than a shelf ornament. The Policies and Procedures exist primarily in electronic format on the program intranet. Through constant communication and feedback, necessary changes can be identified, incorporated, and communicated back out to the team via email in a matter of hours.

The primary source of disagreement among program managers is on the proper role of outside contractors and consultants in providing design assistance. At one extreme, one program provides all design assistance using in-house staff with in-depth technical expertise. Contractors are called in to provide specialized assistance but their role remains behind the scenes. The concern, from the program manager's perspective, is to avoid sending a program representative to project design meetings who could be perceived to be in competition with the developer's design team. At the opposite end of the spectrum, one program delegates virtually all technical aspects to a contractor, leaving utility staff to focus on marketing and administrative tasks. Once a project is accepted into the program, the contractor takes a lead role in client relations, attending project design meetings and providing full-scale design assistance. Most program management strategies fall somewhere between the two extremes. However, all agree that the design assistance provider, whether in-house or outside contractor, must be technically knowledgeable and scrupulously objective.

Exhibit NR8-3
Program Management Approaches

Program	Program Management Approach
CA SBD	4 utility program managers and an outside contractor provide program design consulting. Utilities work together to coordinate and share design analysis assumptions and baselines; provide cross-referrals for projects outside their service territory; collect, track, and compile comparable project information and results; and report on program accomplishments and status. Contractor facilitated development of incentive levels and software in 1999. Since 1999, contractor helps SCE supervise evaluations. Within utilities, the program management structures vary. Mostly in-house staff. Utilities hire specialty consultants on a per-project basis for DOE-2 analysis, refrigeration projects, and other tasks that require specialized skills.
HECO C&I NCP	The program is implemented in-house except for third party design assistance and reviews of complex projects.
NGRID D2000+	The implementing organization is primarily in-house. The program has a pre-approved list of third-party technical assistance vendors (engineers), who are available to help on a project-specific basis. The program is marketed primarily by field staff who are also the primary point of contact for traditional utility services.
NSTAR CS	In-house staff responsible for marketing, administration, and program implementation activities. Contractors are retained for certain activities including: 1) technical review of some applications, 2) on-site energy analysis, 3) technical and design assistance for comprehensive projects, and 4) project commissioning services.
NU ECC	NU, CL&P, and WMECo provide in-house program administration and design assistance. NEEP plays a subcontractor marketing role. Independent consultants sometimes help with inspections, building or equipment simulations, and other performance reviews. To avoid any actual or perceived conflict of interest, third-party consultants do not provide design assistance.
Xcel EDA	Utility provides contract administration and marketing. Subcontractors provide modeling and technical assistance, project verification.

Best Practices

Program Management: Project Management
• Make sure program has upper management's buy-in and funding. • Put the process plan in writing. • Keep management teams small. • Maintain active communication with implementation team and stakeholders. • Maintain flexibility to respond to changing market conditions and unforeseen eventualities. • Assemble the most technically proficient implementation team possible. • Provide staff with good training. • Reward high performing staff. • Make sure that program managers and staff at all levels have decision-making authority commensurate with their responsibilities.

Best program management practices for Non-residential New Construction programs include the following:

- **Make sure program has upper management's buy-in and funding.** Non-residential new construction projects have multi-year planning and construction horizons, which means that programs require several years to generate tangible impacts. Upper management must embark on the process with patience, reasonable expectations, and a commitment to fund the entire start-up phase.

- **Put the process plan in writing** and then write down all important decisions that interpret plan elements. A written plan is more likely to be a well thought-out plan and is easier to disseminate to the various affected stakeholders.

- **Keep management teams small.** Small teams are necessary to maintain close coordination, facilitate good communication, and increase the likelihood of reaching consensus (when multiple entities are involved in decision making).

- **Maintain active communication with implementation team and stakeholders.** Good two-way communication facilitates program flexibility within a structured framework.

- **Maintain flexibility to respond to changing market conditions and unforeseen eventualities.** Clear-cut accountability and good communication with regulators and stakeholders may mitigate tendencies to impose regulatory requirements that limit flexibility.

- **Assemble the most technically proficient implementation team possible.** Whether the program relies on in-house staff or contractors to provide design assistance and

technical support, make sure service providers are experienced, knowledgeable, and able to understand project proponents' concerns.

- **Provide staff with good training.** Match the training to their skill needs. Program services will only be as good as the people who deliver them. Human resources are as important to program success as financial resources.

- **Reward high performing staff.** Link staff performance evaluations to tangible measures, which are known upfront and developed together. Staff will perform better when they clearly understand what is expected of them and they agree that the expectations are reasonable. Good staff management minimizes turnover and promotes program stability.

- **Make sure that program managers and staff at all levels have decision-making authority commensurate with their responsibilities.** A good balance between authority and responsibilities is a prerequisite for performance expectations that are perceived as reasonable. Delegate responsibility and authority to avoid institutionalized bottlenecks.

3.3 PROGRAM MANAGEMENT: REPORTING AND TRACKING

All of the programs the research team reviewed had some process for reporting and tracking the progress and/or impact of program activities. At a minimum, the tracking systems supported periodic (usually quarterly or annual) regulatory reporting of program impacts and expenditures. Most program managers also use their tracking system information to support financial accounting and program evaluation.

Tracking systems varied widely in their complexity. At one end of the spectrum, NU ECC maintains a spreadsheet for calculating savings, demand impacts, and incentives for typical measures, which links to a Foxpro database. In addition to regulatory reporting, the tracking system is used to track project milestones and expedite incentive payments. At the other end of the spectrum, the NGRID D2000+ system documents participation metrics, impact metrics, and performance-based metrics by marketing segment. It also documents the following project/program interactions:

- Pre-approval phase – the application gets technical review, money reserved, and customer signatures. System tracks various steps and automatically notifies program managers when a step is skipped or performed incorrectly.

- Approval phase – Once the application is approved it is "committed" and gets assigned an expected completion date (for tracking progress toward program goals). System tracks progress toward milestones, automatically generates letters if milestones are missed.

- Project completion – System tracks post-inspection, customer signatures, utilities review and approval, check paid.

The tracking system is tied to accounts payable, which permits the system to incorporate checks and balances (safeguards and quality control) and to match the payment to the measure.

Several program managers noted plans or ongoing efforts to expand their tracking system to capture more comprehensive information. For example, the NSTAR CS program manager lamented the limitations of "just counting widgets." The program experiences a "Hockey Stick Effect" (long lead times with few rebated projects and then a rush of project completions at the very end). A comprehensive tracking system that monitors project progress will help gauge the expected magnitude of that rush before it actually hits.

Exhibit NR8-4 shows the different reporting and tracking methods used by each program.

Exhibit NR8-4
Reporting and Tracking Tools

Program	Method
CA SBD	Tracking systems are used to track contacts and applications, through project stages. They track estimated savings and incentives and link to contract and verification process. Tracking systems support evaluations and quarterly regulatory reports. Tracking systems are utility-specific, because they are tied to contract and financial systems, which are utility-specific. Due to customer non-disclosure issues, a statewide tracking system is not possible.
HECO C&I NCP	Tracking system records participant information, contractor, project cost, and key transaction dates. It also calculates energy and demand savings based on planning values. Lookup tables map equipment to expected impact values. Tracking provides program manager with monthly reports summarizing the current program status, including activity for current month, year to date, and backlog.
NGRID D2000+	The tracking system documents participation metrics, impact metrics, and performance-based metrics by marketing segment. At key project phases (i.e., pre-approval, approval, and completion), system tracks implementation and administration steps, tracks progress toward milestones, and provides notifications if steps or milestones are missed. Between project initiation and completion, account managers follow field conditions using their own internal project tracking systems.
NSTAR CS	Revised tracking system will track work in progress, projects in construction. The program experiences a "Hockey Stick Effect" (long lead times with few rebated projects and then a rush of project completions at the very end). A comprehensive tracking system is important for gauging the expected magnitude of that rush before it actually hits.
NU ECC	Spreadsheet is used to calculate savings and incentives for typical measures. Results go into Foxpro database, which tracks expenditures and measure-level impacts.
Xcel EDA	Tracking system tracks project leads, impacts, and expenditures. Tracking system is connected to billing system, which is used to cut rebates. Independent contractor maintains its own internal tracking system.

Exhibit NR8-5 summarizes the different functions the tracked information serves.

Exhibit NR8-5
Reporting and Tracking Functions

Function	CA SBD	HECO C&I NCP	NGRID D2000+	NSTAR CS	NU ECC	Xcel EDA
Reporting to upper management / regulators	✓	✓	✓	✓	✓	✓
Program impact calculations	✓	✓	✓	✓	✓	✓
Internal performance monitoring / quality control / project status tracking	✓	✓	✓	✓	✓	✓
Automated notification of missed milestones			✓			
EM&V	✓	✓	✓	✓		
Financial accounting	✓		✓		✓	✓
Project lead tracking						✓
Set program priorities, goals, budget	✓					
Load research and forecasting		✓				
Staff performance evaluations						✓

Best Practices

Program Management: Reporting and Tracking
• Define and identify the key information needed to track and report early in the program development process. • Minimize duplicative data entry. • Develop accurate algorithms and assumptions on which to base estimates of savings. • Design databases to be scalable to accommodate changes on program scope. • Use the Internet to facilitate data entry and reporting for private-sector market actors. • Automate routine functions such as monthly reports. • Build in rigorous quality control screens for data entry. • Carefully document the tracking system.

Best reporting and tracking practices for Non-residential New Construction programs include the following:

- **Define and identify the key information needed to track and report early in the program development process.** Clearly articulate the data requirements needed to measure success. Identify all the stakeholders and their information needs and design accordingly.

- **Minimize duplicative data entry**; rather, link databases to exchange information dynamically. This is especially important if the program uses separate tracking systems for program participation, inspection scheduling and coordination, and customer billing.

- **Develop accurate algorithms and assumptions on which to base estimates of savings.** Use tracking system results to periodically review deemed savings estimates and bring them in line with actual building performance. This exercise will help set reasonable expectations and avoid the temptation to oversell program benefits.

- **Design databases to be scalable to accommodate changes on program scope.** Doing so will enhance the program's overall flexibility and ability to respond to unforeseen market conditions.

- **Use the Internet to facilitate data entry and reporting for private-sector market actors.** Internet access is now widespread and electronic data transfer and sharing can greatly enhance the quality and cost-effectiveness of information management. Internet-based systems can help minimize duplicative data entry and storage and automate many routine quality-control steps.

- **Automate routine functions such as monthly reports.** Doing so provides an opportunity to build in quality control checks and frees staff time for more strategically important tasks.

- **Build in rigorous quality control screens for data entry.** Program the tracking software to reject inconsistent, inaccurate, or incomplete data to minimize the extent of subsequent data cleaning and enhance the accuracy and credibility of reported results.

- **Carefully document the tracking system**, including database structure, data field definitions and screening criteria, and data entry and analysis procedures. Good documentation will help mitigate problems stemming from staff turnover, especially when the system must serve a variety of users with varying computer skill levels.

3.4 PROGRAM MANAGEMENT: QUALITY CONTROL AND VERIFICATION

Quality control and verification provide a number of key benefits, the most important being verification that program expenditures are tied to real savings and that projects are in compliance with local energy efficiency codes and standards. Depending on the scope of verification, the function can provide an important quality control service to the builder by:

- Assuring that measure installation and startup operation conforms to its design intent

- Promoting the application of best practices in construction

- Limiting builder's financial exposure to construction defect issues (by providing additional quality control and project documentation)

The core quality control and verification procedures for all programs reviewed included pre-project review of construction documents and post-project on-site inspections to verify as-built conditions. Verification requirements for custom and whole-building projects were much more rigorous than requirements for systems or prescriptive-measure projects. As a general rule, all but the smallest projects get some type of post-installation on-site inspection. NU ECC was the only program that reported accepting self-certification of prescriptive measures.

All programs require some type of pre-project review. This step generally involved review of construction documents to determine which qualifying measures were planned for the project. This step also typically involved an independent review of as-designed impact calculations or building simulations. At this stage, the California utilities draft in Incentive Agreement that specifies which measures will go into the project. Similarly, NGRID D2000+ and NSTAR CS prepare a Minimum Requirements document that spells out the inspections required.

Upon completion, all custom projects and most prescriptive projects receive some type of on-site inspection. Some programs wait until the building is occupied to inspect in order to verify chiller optimization, VAVs, and energy management system programming. The purpose of the inspections is to compare as-built to as-designed conditions and determine the final incentive amount.

PG&E described the most involved process of checks, double-checks, and quality control. PG&E verification includes full inventory of all incentive features in all systems. A technical auditor checks the field engineer data. The program engineer conducts a second review before reserving the funds. Any system change between as-designed and as-built triggers a full building re-analysis. Incentive payments are tied to as-built results, which may be more or less than the reserved amount based on as-designed results. For custom incentives, HECO C&I NCP may require the customer to provide verification of the savings by a professional engineer (documented by stamping and signing the proposal in a prominent location).

Programs varied considerably in their commissioning requirements, though this may stem as much from varying definitions as differences in actual practice. For complicated measures, NU ECC conducts a "measure performance verification" which it describes as equivalent to low level systems commissioning. NSTAR CS requires formal systems commissioning for controls projects over $40,000 in value and all projects over $100,000. NGRID D2000+ has similar requirements: large projects require a third-party commissioning agent. HECO C&I NCP also requires building commissioning in some cases. California's verification includes some installation quality control, at least for control measures, but it is not characterized as a full performance verification or commissioning.

Best Practices

Program Management: Quality Control and Verification
• At the project outset, clearly identify qualifying measures to be included in the project, along with their expected impacts. • Clearly define post-inspection policies and procedures. • Track every project at every phase. • Make sure that project inspectors are equipped with the training and experience required for the task. • For complex projects, especially those involving controls, consider requiring performance verification. • Tie verification to full building occupancy.

Ex-post evaluation results provide a good indicator of the effectiveness of quality control and verification procedures. Both NU ECC and California cited realization rates near 100 percent as evidence that the verification process works well.[1] Best quality control practices for Non-residential New Construction programs include the following:

- **At the project outset, clearly identify qualifying measures to be included in the project, along with their expected impacts.** Program managers and participants should agree upfront which project elements qualify for a program incentive and how subsequent modification of those elements could affect the incentive amount.

- **Clearly define post-inspection policies and procedures** that address issues such as when and how to sample, how to address data gaps, etc.

- **Track every project at every phase.** Construction projects are subject to a variety of forces that modify project schedules and design. Careful project tracking is the only way to assess the implications of those modifications for future program. Good tracking is a prerequisite for good budget management.

- **Make sure that project inspectors are equipped with the training and experience required for the task.** Be prepared to bring in outside consultants to assist with particularly complicated projects.

- **For complex projects, especially those involving controls, consider requiring performance verification.** Ideally, commissioning should be required, at least for more complex projects. At a minimum, system performance verification provides assurance that incentive payments are tied to real savings and that measure installation and startup operation conform to its design intent.

[1] The realization rate is calculated as the program-level ex-ante impacts based on verification results, divided by program-level ex-post impacts based on evaluation results.

- **Tie verification to full building occupancy.** An empty building should get no commissioning and no payment. Partial occupancy should trigger a reassessment of operational inputs to savings estimates. Verification of measures such as chiller optimization, VAVs, energy management systems, and lighting controls should ensure that systems are optimized for actual occupancy and loads.

3.5 PROGRAM IMPLEMENTATION: PARTICIPATION PROCESS

The participation process is generally similar across programs and typically involves the following steps:

1. Customer or customer's design team prepares and submits application, which may include project specifications, submittals, and drawings, depending on the project scope.

2. Program reviews application and analysis to determine energy savings and demand reduction potential. Program may also provide some assistance in developing the impact models. Programs typically provide detailed guidelines regarding acceptable modeling strategies and input assumptions.

3. Program may conduct pre-installation survey of existing facility, if applicable. Program may also provide assistance in determining appropriate participation track.

4. Program sends customer pre-approval letter specifying approved rebate amount and date project must be complete to qualify for payments. Pre-approval may also include contractual language specifying minimum requirements that the project must meet to qualify for incentives.

5. Program staff or implementation contractor may play an active role in the project design process.

6. Customer hires vendors and completes project. Utility may monitor project progress.

7. Upon project completion, customer provides program with documentation that project satisfied the minimum requirements. Documentation may include itemized invoices, as-built drawings, etc.

8. Program may conduct post-installation verification inspection.

9. Once program verifies that all minimum requirements have been met, it pays incentive.

The programs we reviewed all emphasize the importance of good design in promoting energy-efficient new construction. The programs all offer some type of design assistance and, with one exception, generally promote the strategy of incorporating energy efficiency considerations into the project design at an early stage through an integrated design process. The NU ECC program focuses its design assistance on the HVAC and lighting systems. It does not attempt to affect building layout or schematic design; for example, it does not attempt to promote day-lighting.

The programs also all offer simpler participation alternatives for smaller, simpler projects and projects that are too far along in the planning process to benefit from integrated design. The

simpler tracks can take one of two forms: (1) prescriptive rebates for pre-approved energy-efficient technologies; or (2) systems-level incentives for custom-designed energy efficiency projects with a limited scope. Some programs offer both a prescriptive and customized project track in addition to the integrated or comprehensive design option. NGRID D2000+ was the only program sponsor who mentioned commissioning as a program service or requirement.

Different programs place varying degrees of emphasis on the whole building versus systems or prescriptive approach. One program manager noted that a whole building approach does a better job of capturing all cost-effective energy efficiency opportunities. It thus delivers higher savings per project square footage. It also transfers more skills to the project design team, which makes it more attractive from a market transformation perspective. A systems or prescriptive approach is more attractive from a resource acquisition perspective because it requires less program involvement with the project and generates higher savings per program dollar. Within a market transformation framework, a systems component can be a useful tool for overcoming resistance from developers who believe that integrated design is unduly expensive. The systems approach enables the program to develop a relationship with the developer and begin educating him on the benefits of integrated design, which makes it easier to sell a whole building approach on subsequent projects.

The programs we reviewed all provide design incentives, as well as construction incentives for energy-efficiency improvements. Design incentives are often restricted to large, complex projects. The philosophy behind design incentives is that more detailed design and analysis can often yield substantial energy efficiency opportunities that have minimal incremental cost. Equipment-based incentives (especially incentives tied to incremental construction costs) typically would not reward such measures or would reward only the project owner, leaving the design team to shoulder the burden of extra design time and expense. The NU ECC program extends its design incentives to cover the cost of design changes.

With a couple exceptions, construction incentives are tied to incremental project costs. Hawaii Electric ties its incentives to project payback. NGRID D2000+ uses a combination of incremental cost and project payback to determine project incentives. Until recently, NSTAR CS also used a combined approach but switched to relying solely on incremental cost in 2002.

Free ridership and gaming are important considerations in designing program incentive structures. The NU ECC program manager explained his preference for cost-based incentives by explaining that performance-based incentives encourage project proponents to exaggerate program impacts via inflated operating hours, etc. Expected project impacts are used only as an initial screen. Of course, cost-based incentives can create gaming opportunities. NU ECC no longer publishes its incentive schedule after finding that incremental costs went up in response to published incentives. For prescriptive measures, incentive levels are set ahead of time, based on market-wide incremental costs. For custom measures and whole-building projects, the project proponents must document actual incremental costs.

Project impacts are calculated relative to federal and state standards, where applicable. No programs indicated that they pay for improvements that only bring a facility up to code. In the absence of applicable codes, programs establish baselines relative to prevailing industry practices.

Best Practices

Program Implementation: Participation Process
• Get involved early in the project design process. • Structure participation requirements to discourage the design team from cutting energy efficiency features during value engineering. • Maintain a flexible participation strategy. • Provide project proponents with guidance about participation options. • To facilitate participation from the customer's perspective, work with project engineers to obtain design parameters and related technical information. • Obtain HVAC and lighting calculation inputs directly from project drawings and plans. • For projects involving DOE2 simulations, establish definitive base case and final scenarios. • If incentives are performance-based, then incorporate other disincentives to inflate savings via exaggerated operating hour estimates, etc. • If incentives are based on incremental costs, then make sure program managers have access to solid, up-to-date information regarding industry average costs for typical measures. • Develop a baseline document that provides guidelines for determining the appropriate benchmark for energy impact and incremental cost calculations. • In the field, avoid over-committing to a project before the design parameters are known.

Best participation process practices for Non-residential New Construction programs include the following:

- **Get involved early in the project design process.** The further along in the design process, the more limited the opportunities to incorporate energy efficiency strategies without incurring change orders and other project disruptions.

- **Structure participation requirements to discourage the design team from cutting energy efficiency features during value engineering.** Design incentives should translate into tangible design improvements and energy savings.

- **Maintain a flexible participation strategy.** The whole building process is more time-consuming with the client. A customized or systems approach accommodates projects that require a degree of design flexibility but not the level of planning that the whole building process entails. A prescriptive approach enables project designers to incorporate pre-screened measures that fit within the project's design specifications.

- **Provide project proponents with guidance about participation options.** Multiple participation options enable a program to accommodate a greater variety of construction

projects but they add to the complexity of participant decision making. Couple multiple participation options with structured guidance to minimize participation barriers.

- **To facilitate participation from the customer's perspective, work with project engineers to obtain design parameters and related technical information.** In this way, customer participation requirements can be reduced to just signing the contract and cashing the incentive check.

- **Obtain HVAC and lighting calculation inputs directly from project drawings and plans** in order to get the most accurate possible numbers.

- **For projects involving DOE2 simulations, establish definitive base case and final scenarios.** To support incentive calculations, as-built measure verification, and program evaluation, project folders should clearly document the final DOE2 simulations used to determine base-case and final conditions.

- **If incentives are performance-based, then incorporate other disincentives to inflate savings via exaggerated operating hour estimates, etc.** All incentive structures should be critically reviewed to minimize gaming opportunities. Performance-based structures are particularly vulnerable due to the variety and complexity of input assumptions required to determine expected performance.

- **If incentives are based on incremental costs, then make sure program managers have access to solid, up-to-date information regarding industry average costs for typical measures.** Lack of such information creates opportunities for project proponents to game the system.

- **Develop a baseline document that provides guidelines for determining the appropriate benchmark for energy impact and incremental cost calculations.** Establishment of appropriate baselines is a perennial challenge for new construction programs. Creation of a baseline document helps program staff and participants to arrive at a common understanding of expected project impacts.

- **In the field, avoid over-committing to a project before the design parameters are known.** A solid understanding of project design parameters facilitates targeted deployment of program resources and minimization of free ridership.

3.6 PROGRAM IMPLEMENTATION: MARKETING AND OUTREACH

The programs we reviewed employed remarkably similar marketing and outreach strategies, undoubtedly reflecting common solutions to a common set of challenges. The non-residential new construction industry represents a marketing challenge because standard mass marketing methods are completely ineffective. The number of key decision makers is a small fraction of the general population so programs would have to saturate mass media channels in order to be sure of reaching target audiences. Moreover, simple messages that are suitable for mass media lack any persuasive impact on decision makers who are faced with complex technical, budgetary, and scheduling challenges.

The complexity of the marketing challenge is compounded by the fact that most projects offer only a narrow window of opportunity to positively influence the project. Unfortunately, there are few reliable information sources for identifying non-residential construction projects in the early stages before the window of opportunity closes.

In response to these marketing challenges, the programs we reviewed focus significant resources on building relationships with members of the design community, particularly architects and mechanical engineers. These relationships cultivate the A&E professionals as program proponents. They are able to alert program staff to opportunities as soon as a client comes to them with an idea. Their familiarity with the program facilitates participation because they understand program documentation requirements and can handle the application details, thus freeing the project owner to just sign the application and cash the incentive payment. As trusted technical advisers to the project owner, they are able to confirm the value of program participation. Finally, programs are able to build on these relationships to provide technical training that drives program spillover benefits.

While no programs reviewed specifically mentioned local governments as key allies or stakeholders, anecdotal evidence from other sources indicates that local governments can be effective in identifying projects early in the design process and getting the energy efficiency program involved. The key departments are those involved with planning and permitting.

Every program employs a portfolio of outreach strategies to reach its target audience. Typical strategies include:

- Direct outreach: e.g., phone calls and face-to-face meetings
- Networking at breakfast meetings
- Brownbag workshops and "lunch and learns"
- Attendance at trade shows and construction showcases to publicize program benefits and gather contact information
- Training and education in partnership with allied industries, energy centers, and professional organizations
- Design awards programs to draw attention to successful designers and their projects
- Partnerships with key industry allies and professional associations; e.g., American Institute of Architects
- Case studies and fact sheets
- Paid advertising and free stories in industry trade journals
- Newsletters, either hard-copy or electronic
- Program websites

Best Practices

Program Implementation: Marketing and Outreach
• Avoid mass marketing techniques such as direct mailings; newspaper, radio, and TV ads; and telemarketing. • Leverage trade ally opportunities, trade association trainings, annual meetings, etc. • Sell customer benefits first, then energy efficiency; know your customers and their needs. • Keep benefits quantifiable in terms of economics. Promote a life-cycle cost perspective of benefits. • Understand building technologies and construction practices, along with their customer benefits (energy and non-energy).

Best marketing and outreach practices for Non-residential New Construction programs include the following:

- **Avoid mass marketing techniques such as direct mailings; newspaper, radio, and TV ads; and telemarketing.** Mass market techniques are rarely effective in identifying individual decision makers involved with new construction projects; key decision makers in this market require more personalized outreach to be persuaded to participate.

- **Leverage trade ally opportunities, trade association trainings, annual meetings, etc.** Trade ally relationships will generally be more effective than mass marketing at generating project leads. Relationships with architecture and engineering (A/E) professionals are particularly important since, in many cases, they will be the primary conduit for identifying projects in the schematic design stage. Local government planning and permitting departments may also be helpful allies.

- **Sell customer benefits first, then energy efficiency; know your customers and their needs.** Energy efficiency messages rarely resonate with the customer. Economic benefits tend to be more persuasive. To close the deal, the program representative must understand the customer's needs and barriers and be able to articulate the benefits of program participation in language the customer understands and finds compelling.

- **Keep benefits quantifiable in terms of economics. Promote a life-cycle cost perspective of benefits.** To the extent possible, quantify health and productivity benefits. Project proponents often lack key information regarding the life-cycle cost implications of their design alternatives. Clear presentation of this information can be persuasive.

- **Understand building technologies and construction practices, along with their customer benefits (energy and non-energy).** Provide formal training for program marketing staff throughout the year. Hold meetings with manufacturers and vendors to

better understand the technologies they offer. Solid technical expertise is a prerequisite for understanding customer needs and gaining customer confidence.

3.7 PROGRAM EVALUATION

The depth and scope of evaluation activities varies dramatically across the non-residential new construction programs analyzed, largely in response to varying reporting requirements imposed by management or regulatory agencies. Xcel EDA provides brief annual summaries of program activities and results for senior management. Results are drawn almost entirely from in-house tracking systems and are prepared by program staff. California and programs in the Northeast hire third-party evaluators to conduct extensive primary data collection and develop ex-post estimates of program impacts.

One limiting factor of impact evaluations is that they must rely for data on projects that have been completed and paid. Given the extended timeframe required from project initiation to completion, these projects reflect program marketing and implementation practices from several years earlier. As a consequence, program managers cannot rely only on impact evaluation results to identify opportunities for program improvement. Thus, comprehensive evaluations must engage on two tracks, a process evaluation element that provides timely feedback from one program year to another, and an impact evaluation process that necessarily must follow project installation.

A related issue is that the extended timeframe for completing projects complicates the cost-benefit analysis. The typical methodology of calculating costs and benefits for a given program year requires a prolonged wait before program benefits are completely known. Alternatively, program costs could be disaggregated and allocated to each project, which permits calculation of total costs and benefits for the set of projects completed in a given year.

Evaluation approaches for the programs reviewed are summarized below:

- **CA SBD.** The program has conducted four key studies since 2001: *NRNC Market Characterization and Program Activities Tracking Report* (2002); *Energy Design Resources Evaluation*; *Building Efficiency Assessment* (2001), and *2002 Building Efficiency Assessment Study* (2004). Results for 2002 indicate that measures incented through the program generated 87 percent of the ex ante estimated energy and demand savings. Whole building design accounted for 12 percent of 2002 program participation and approximately 28 percent of gross program savings. The Whole Building Approach generated roughly three times the energy savings per project square foot of the Systems Approach. The Building Efficiency Assessment calculated a 2001 Net-to-Gross ratio of 0.82 and a 2002 ratio of 0.65. The 2001 value was adopted by the PUC as the ex-ante NTG value for future program years. The BEA study relies on a self-report approach. Based on 2001 evaluation findings, the program has adapted Energy Design Resources classes and marketing methods. Evaluation also found that the cost for penetrating the small commercial market was too high for the benefits achievable, which prompted a review of hard-to-reach customer thresholds and targets.

- **HECO C&I NCP.** HECO has completed two program impact evaluations and a measure cost study to support cost-benefit analysis. The most recent impact evaluation, completed in 2001, evaluates the 1998-99 program year. The evaluation identified

several issues related to baseline assumptions for ex-ante impact calculations that translated into realization rates that diverged significantly from 1.0. Evaluators also found savings persistence issues with HVAC and lighting controls. Evaluation results led to corrections in ex-ante savings calculations and several programmatic changes. For example, account representatives now focus greater attention on helping customers maintain properly programmed controls systems, particularly when there is change-over in facility management.

- **NGRID D2000+.** In support of its 2002 DSM Performance Measurement Report filing, NGRID conducted studies: *2002 Commercial and Industrial Free-ridership and Spillover Study*; *Design2000plus Lighting Hours of Use and Loadshape Measurement*; *Evaluation of 2001 Custom Process Installations*; and *Evaluation of 2001 Custom HVAC Installations*. These most recent evaluation studies focused on program impacts. The utility gets good program feedback from interveners so a process evaluation was determined to be unnecessary. Key evaluation findings call for more emphasis on generating lasting market changes by (1) leveraging private sector activities more aggressively; (2) focusing on trade ally education; and (3) coordinating with regional market transformation programs to the greatest extent possible. The report also recommends placing greater emphasis on reducing electricity usage during peak demand periods. The impact evaluation results have led to changes in the baseline and changes in the program technology mix. The program added a documentation checklist for custom projects to make it easier for evaluators to follow the application logic.

- **NSTAR CS.** The program has undergone impact evaluations of the 1999/2000 program and 2001 program years. The most recent impact evaluation generated a number of recommendations for determining and applying appropriate measure baselines, improving ex-ante impact calculations, and improving program cost effectiveness. For example, the evaluation recommended the elimination of incentives for minimally code-compliant measures.

- **NU ECC.** The 2000 program evaluation documented gross and net program impacts, completed a technical process survey of program participants, and assessed the program's market effects on various market actor groups. The evaluation identified the need for definitive base case scenarios for DOE2 simulations, modified occupancy sensor savings calculations, and other program modifications.

- **Xcel EDA.** There has been no evaluation since 2001. The next evaluation is planned for 2005. It is expected to assess customer satisfaction, compare as-built performance to modeled performance, and calibrate savings algorithms.

Best Practices

Program Evaluation
• Evaluation metrics must be in line with program goals. • Support program review and assessment at the most comprehensive level possible • Select an evaluator who has a detailed understanding of the market context in which a program operates. • Market-level information about construction practices and energy efficiency measure adoption should be periodically reviewed and updated. • Algorithms for calculating project savings should be periodically reviewed and updated. • For process evaluations, build in ongoing evaluation activities to provide timely, fresh data. • Conduct regular impact evaluations. • Focus cost-benefit analyses on cohorts of completed projects rather than cohorts of initiated projects. • Conduct periodic baseline studies. • Measure both free ridership and spillover effects. • Take evaluation recommendations seriously and incorporate lessons learned into the program.

Best evaluation practices for Non-residential New Construction programs include the following:

- **Evaluation metrics must be in-line with program goals.** One evaluation objective should be to assess program progress toward achieving predetermined goals. The only way to accomplish this objective is to establish metrics that measure that progress.

- **Support program review and assessment at the most comprehensive level possible.** For some programs, this will mean a comprehensive market assessment and impact evaluation, for others it may mean a program review document created in-house. To the extent possible, market transformation programs should measure program impacts. Likewise, resource acquisition programs should look beyond simple participant/non-participant comparisons. More comprehensive results will better permit program managers to gauge program performance over time.

- **Select an evaluator who has a detailed understanding of the market context in which a program operates.** Be sure the evaluation scope provides sufficient interaction between evaluation and implementation staff to give the evaluator a clear understanding of program dynamics. Clear communication channels are essential.

- **Market level information about construction practices and energy efficiency measure adoption should be periodically reviewed and updated.** The degree of sophistication of these market baseline studies will vary, depending on program and market factors. For example, a program operating in a large, highly fragmented market may require a full-scale study to obtain an accurate picture of market conditions; whereas a program in a small or highly concentrated market may be able to compile a reasonable picture of market conditions through its routine interactions with key market players. Keeping abreast of program and measure market penetration is critical.

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

- **For process evaluations, build in ongoing evaluation activities to provide timely, fresh data.** Plan for short time lags between participation and customer interviews to minimize revisionist histories and memory loss. Do not rely solely on impact evaluations to provide recommendations for program improvements several years after the fact.

- **Conduct regular impact evaluations** to verify program cost effectiveness and ensure that as-built engineering estimates of savings are properly calibrated to actual impacts.

- **Focus cost-benefit analyses on cohorts of completed projects rather than cohorts of initiated projects.** The focus on projects initiated in a particular program year entails long delays until all initiated projects are completed and their full costs and benefits known. Implementing this shift requires a methodology for disaggregating program costs and assigning them to specific projects.

- **Develop methods of disaggregating program costs and assigning them to specific projects.** Doing so will permit timely calculation of costs and benefits on cohorts of completed projects and avoid delays associated with compiling benefits for cohorts of initiated projects.

- **Conduct periodic baseline studies** to update incremental cost information, cull out measures that contribute to free ridership due to widespread market adoption, and refocus program on measures and practices that remain cost effective, given changes in the program baseline.

- **Measure both free ridership and spillover effects.** Despite the inherent difficulty of assessing free ridership and spillover, an understanding of both dynamics is necessary to maximize program effectiveness.

- **Take evaluation recommendations seriously and incorporate lessons learned into the program.** Evaluations should be used to improve program performance as well as satisfy regulatory reporting requirements.

4. COMPARISON OF OUTCOMES

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

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

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

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

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

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

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

- **Program/Market Lifecycle** – where a program or key measure is in its product lifecycle will affect its cost-effectiveness. For example, a program seeking impacts from the last 50 percent of the market to adopt a product that has penetrated the first 50 percent of the market should be expected to be more costly than one attacking a market with a low or insignificant saturation level.[2]

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

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

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

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

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

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

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

Exhibit NR8-6 displays cost-effectiveness data for the NR8 Programs. Information is presented on the Total Resource Cost (TRC) test, the associated discount rate and the average measure life, where available. The total program cost shown per kWh saved is an indicator related to the utility cost test in that the numerator includes all program costs and excludes any customer contribution to measure costs. Also shown are non-incentive dollars spent per kW, which offers an indication of the cost to market and administer. Incentive dollars per kW shows the overall average incentive amount per unit of estimated first-year impact.

A comparison of TRC values suggests there may be differences in the costs and benefits included in the calculation and the value of those benefits. The TRC test is one of the most commonly used metrics to determine if a program is cost-effective. Essentially the TRC is calculated as the ratio of the lifecycle avoided cost benefit of all the energy and demand savings, divided by all of the associated program and measure costs (specifically, full measure costs, not just those covered by incentives). Unfortunately, however, TRC values are not directly comparable across jurisdictions because of the variations in avoided costs, measure cost estimates, measure life estimates, and discount rates mentioned above. Calculation of TRC for a given program year is also complicated by extended time lags between project initiation, completion, and evaluation.

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

Despite these caveats, Exhibit NR8-6 illustrates that non-residential new construction represents a cost-effective market opportunity for energy efficiency. Program TRC benefit-cost ratios are all well over 1.0 and three programs reported TRCs over 3.0. These high values likely reflect the high savings potential inherent in large new construction projects, along with relatively low marketing costs to reach the specialized technical professionals who design and build them.

In addition to quantitative benefits, program managers reported a variety of qualitative evidence that their programs were achieving the desired market effects. In some regions, program success has contributed to steadily more stringent building energy standards. Design professionals are demonstrating increased understanding of comprehensive design issues over time. In some cases, designers have changed their master specifications, which affect every project going forward. Many institutions have adopted higher efficiency design as a standard practice. According to some program managers, T-8s have become a standard specification for lighting systems and variable speed drive motors are now common.

Exhibit NR8-6
Program Effects

Element	CA SBD	HECO C&I NCP[3]	NGRID D2000+	NSTAR CS	NU ECC[4]	XCel
Period Reviewed	2002	1999	2002	2001	2002	2002
Net to Gross Ratio	65%	75%	81%	67%	93%	NAV
Free Ridership Rate	40%	NAV	NAV	33%	7%	NAV
Total Resource Cost/Societal Test	2.43	1.30	1.72	5.08	3.2	6.74
Average measure life (years)	16-20	NAV	NAV	18	18	20
Net MWh (Annual)	82,697	8,546	31,804	14,230	33,365	NAV
Gross MWh	127,216	11,394	39,313	21,198	36,070	63,093
Net kW (Annual)	18,600	1,185	6,429	1,710	10,662	NAV
Gross kW (Annual)	28,600	1,580	7,947	2,880	11,464	19,100
Real Discount Rate	8.15%[5]	NAV	NAV	2.78%	NAV	5.97%
Budget Per Impact						
Program Expenditures ($000)	22,604	935	13,916	7,926	$7,435	5,650
Incentive Expenditures ($000)	13,469	631	12,060	5,209	$5,937	3,169
Program $/first-year kWh saved[6]	0.18	0.08	0.35	0.37	0.21	0.09
Incentive Dollars per kWh	0.11	0.06	0.31	0.24	0.17	0.05
Non-Incentive Dollars per kWh	0.07	0.03	0.05	0.13	0.04	0.04
Program $/first-year kW saved[5]	790.35	591.77	1,751.14	2,752.08	645.04	295.81
Incentive Dollars per kW	470.94	399.37	1,517.58	1,808.68	515.07	165.92
Non-Incentive Dollars Spent per kW	319.41	192.40	233.55	943.40	129.96	129.89

[3] As filed with the Hawaii Public Utility Commission, based on ex-ante results.

[4] Connecticut Light and Power only

[5] Nominal

[6] Calculated as a function of gross impacts

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APPENDIX NR8A – BRIEF INTRODUCTION TO THE NATIONAL ENERGY EFFICIENCY BEST PRACTICES STUDY

INTRODUCTION

This report presents results of a comparative analysis of residential lighting 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

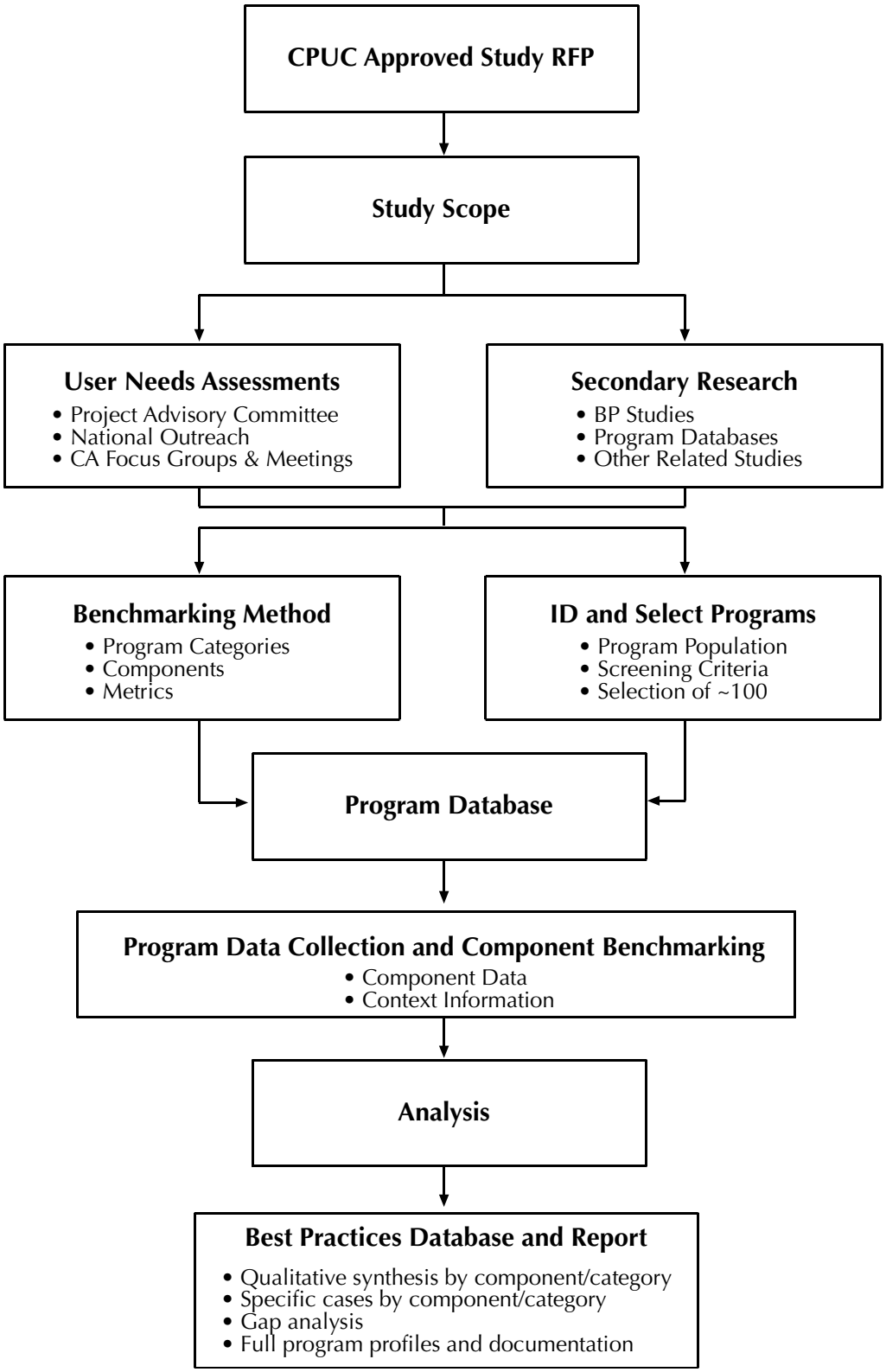
The overall goal of the Best Practices Study is to develop and implement a method to identify and communicate excellent energy efficiency program practices nationwide in order to enhance the design of such programs in California. In particular, program implementers supported through public goods funds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

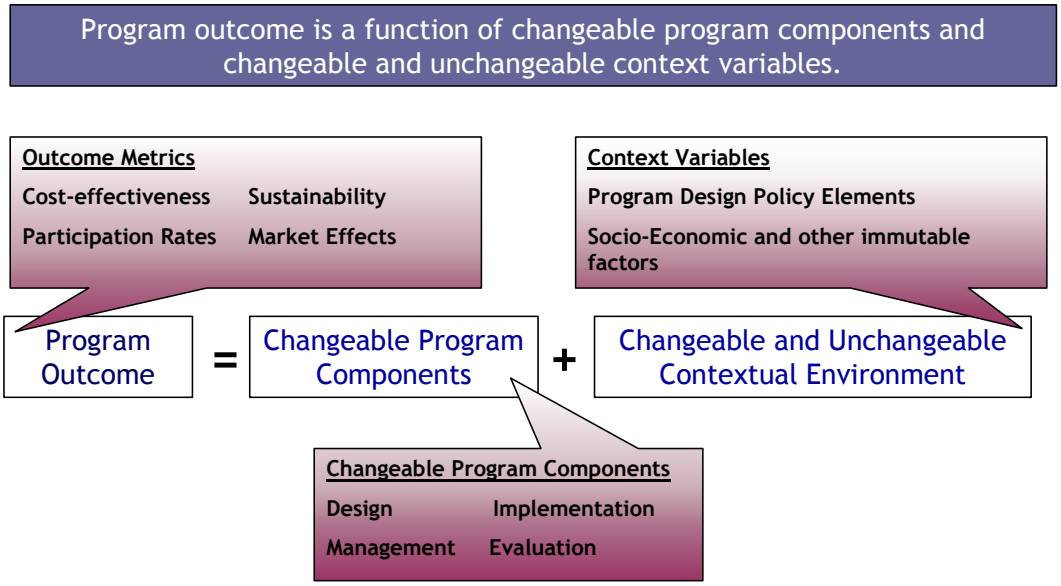
Key aspects of the Best Practices Study include a user needs assessment, secondary research, development of the benchmarking methods, identification and selection of programs to benchmark, development of the program database, data collection and program benchmarking, analysis, and preparation of the 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 NR8-7 below.

Exhibit NR8-7
Overview of Energy Efficiency Best Practices Study



As shown below in Exhibit NR8-8, 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 NR8-8
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 NR8-9 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 NR8-9
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.