ORIGINAL

Florida Power & Light Company, P.O. Box 029100, Miami, FL 33102

FPL

April 16, 2001

BY HAND DELIVERY

Blanca S. Bayo, Director
Division of Records and Reporting
Florida Public Service Commission
4075 Esplanade Way, Room 110
Tallahassee, Florida 32399

010000-PU

Re: Commercial/Industrial New Construction Research Project Final Report

Dear Ms. Bayo:

In Order No. PSC-97-0091-FOF-EI, issued on January 27, 1997, the Florida Public Service Commission approved Florida Power & Light Company's request to conduct research concerning potential demand-side management (DSM) opportunities in the commercial/industrial new construction market. Subsequently, on September 20, 1999, Order No. PSC-99-1852-PAA-EI was issued which extended the project timeline by sixteen months.

Introduction

The purpose of this project was to determine whether a cost-effective commercial/industrial new construction (CINC) energy efficiency program could be developed that would encourage more utilization, in Florida, of the best available energy conservation measures (ECMs). The program was carried out in four phases:

- In Phase 1, a thorough literature review was used to identify commercially available ECMs.
- In Phase 2, a computer model was developed to simulate the effect of using different ECMs in new C/I buildings. The model was subsequently used to simulate the effect of using each of the Phase 1 ECMs in new buildings in Florida, instead of using the baseline technologies identified in Phase 3. Individual ECMs were evaluated against the RIM and Participant tests to determine which measures might qualify for inclusion in a CINC demand management program.
- In Phase 3, which was conducted in parallel with the second phase, a field review of the CINC market in Florida was conducted. Baseline technologies actually being used in new construction were identified. Individual buildings were surveyed and metered to verify their energy efficiency performance in comparison with the documents submitted when they were built.
- In Phase 4, a review of the new construction marketplace was carried out, and potential program designs were evaluated. Conclusions and recommendations were developed.

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Results

- New buildings in Florida are already making effective use of energy conservation measures. The average new C/I building in Florida substantially exceeds the requirements of the Florida Energy Efficiency Code, with a rating of 65, which is 35% more efficient than the mandated rating of 100.

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- Some of the most attractive ECMs are already included in FPL DSM programs for which new buildings are eligible.
- Numerous commercially available ECMs were identified during this study. If adopted by 100% of the C/I new construction market, use of the most effective ECMs could reduce summer peak demand in FPL's service territory by about 100 MW. However, using these measures would increase the cost of new construction by about 2.5%. FPL's experience with the residential BuildSmart program has shown that builders prefer to invest in visible upgrades, rather than invisible ECMs. It was estimated that a CINC DSM program could capture up to 14% of this potential market, which would provide 14 MW of demand reduction. The startup cost of such a program is estimated to be $500,000, and ongoing operating costs are estimated to be about $3.4 million/year.
- The commercial new construction market is quite complex. As many as six different market players (architects, engineers, contractors, commissioning agents, property managers and building owners) can be involved in the selection of ECMs for each building.

Conclusions/Recommendations

- FPL can encourage the use of some of the identified ECMs.
  - FPL is already encouraging the use of the most effective identified ECMs through its existing DSM programs.
  - FPL will publish information to educate CINC market players about additional ECMs identified in this study, such as bronze-tinted windows, that can be used to reduce energy consumption cost-effectively, even without DSM subsidies.

- Development of a CINC DSM program would not be cost-effective and is not recommended.
  - Since new buildings are already substantially exceeding the Florida Energy Efficiency Code (FEEC) requirements, it is not feasible to develop a new CINC DSM program that would encourage the use of individual ECMs in new construction. Builders could accept the subsidies for these measures and then reduce the use of other ECMs, thus providing no net energy savings, while still meeting FEEC requirements.
  - It would not be feasible to sell a comprehensive CINC program (one that would encourage the use of a package of several of the most cost-effective ECMs), because many market players would have to be convinced to use it to affect even one building. Experience from the BuildSmart program has shown that this is exceptionally difficult. Therefore, the projected result of 14 MW of peak reduction is not certain.

Project Budget

This project had an approved budget of $1,525,000. Actual expenditures were $1,161,373, or 24% under budget. Additional details are provided in the final report.

Attached is a copy of the Commercial/Industrial New Construction Research Project Final Report.

Yours truly,

Dennis Brandt

Dennis Brandt
Director, Product Development & Management.

FPL

Commercial/Industrial New Construction Research Project

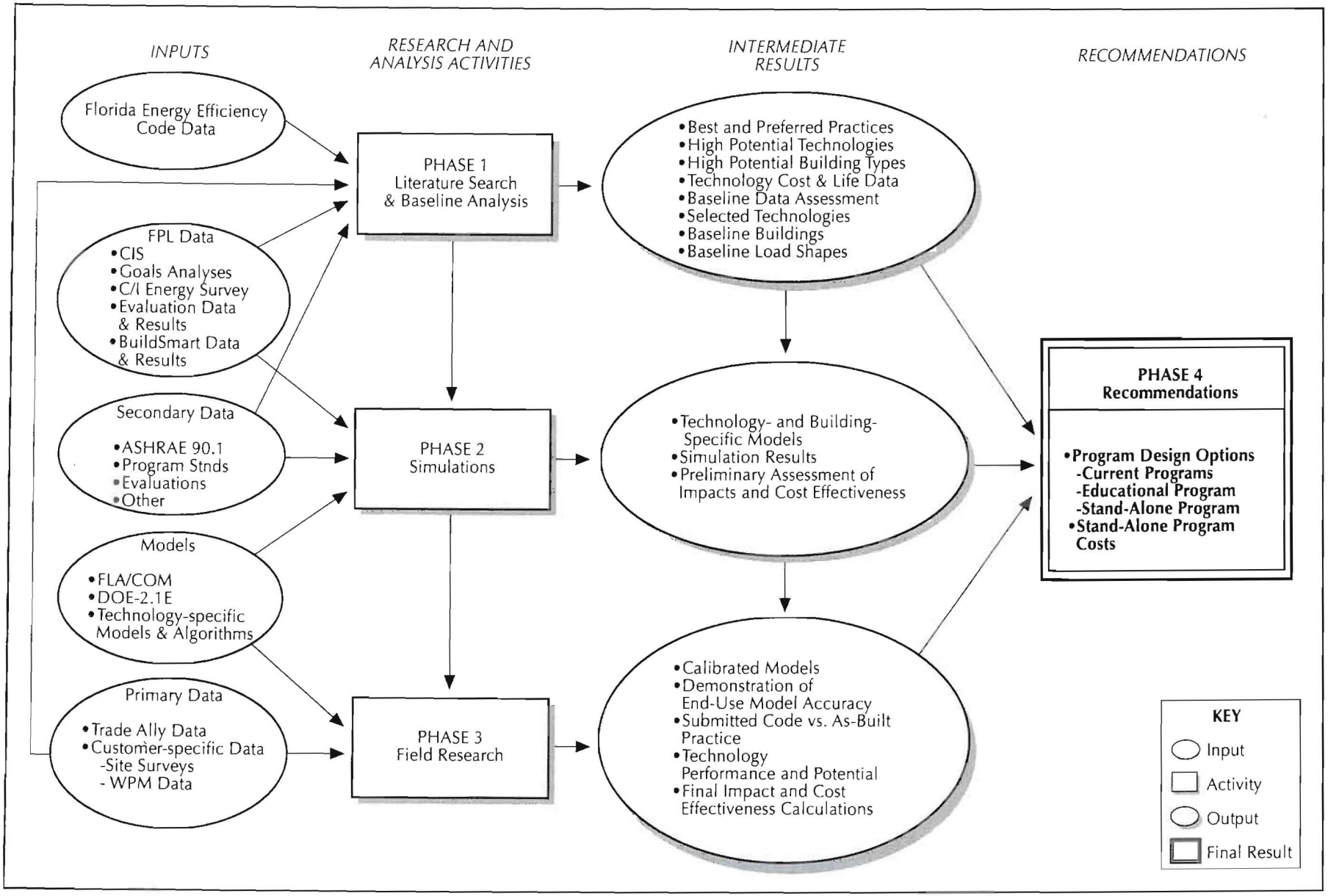
Final Report

March 30, 2001

CONTENTS

1. INTRODUCTION

Exhibit 1-1
Overview of Approach



THE RESULTS OF THE FLORIDA POWER & LIGHT (FPL) COMMERCIAL NEW CONSTRUCTION (CNC) RESEARCH PROJECT ARE PRESENTED IN THIS REPORT.

- This multi-year research effort was conducted to determine whether a cost-effective CNC energy efficiency program can be developed that will enable both FPL and its customers to more effectively utilize the best available energy conservation measures in the Florida market.

- As discussed in more detail throughout this report and illustrated in Exhibit 1-1, extensive primary and secondary data collection and analysis efforts were conducted to assess the viability of an FPL-sponsored CNC program.

  - Current building practices were assessed, forming a baseline from which the impact potential of various energy conservation technologies was measured.

  - Using this baseline, engineering simulations were developed to examine the effectiveness of various energy conservation opportunities in the unique Florida climate. The results from these simulations are presented in chapter 3 along with a brief introductory description of the approach implemented and the data contributing to model development.

  - An extensive program assessment was conducted to examine various program approaches and to narrow designs under consideration to industry best practices. An intensive literature review contributed to this assessment, further strengthened by interviews conducted with various market players and industry experts.

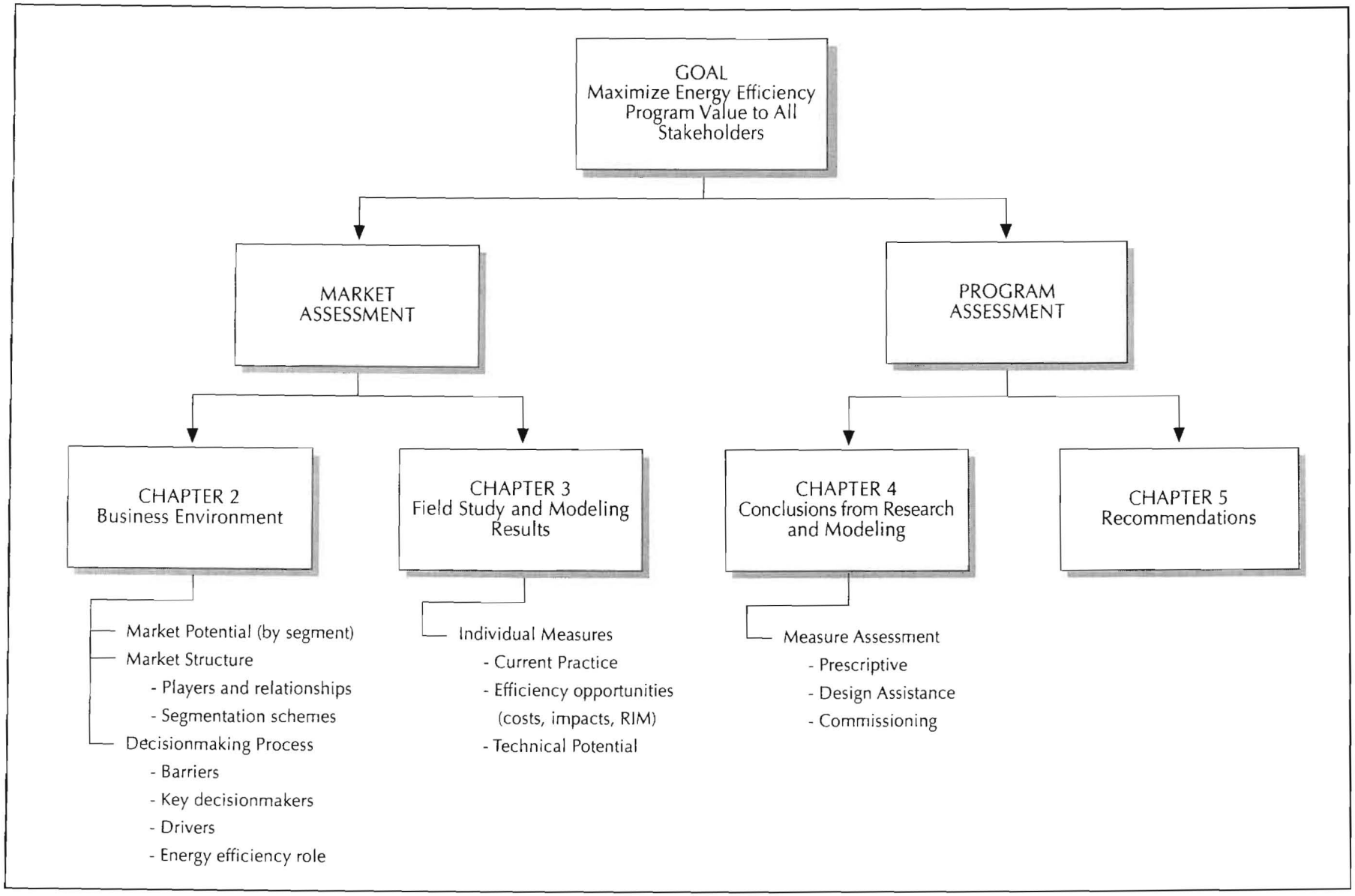
  - These activities were integrated to form recommendations for next steps.

THE RANGE OF COST-EFFECTIVE EFFICIENCY OPTIONS IS GREATER IN NEW CONSTRUCTION THAN IN THE RETROFIT MARKET, BECAUSE, IN NEW CONSTRUCTION, INCREMENTAL COSTS REFLECT EQUIPMENT-ONLY COSTS, NOT (USUALLY) ADDITIONAL LABOR. THIS IS ESPECIALLY TRUE WHEN DESIGN MODIFICATIONS ARE CONSIDERED, WHICH IS RARELY FEASIBLE IN RETROFIT MARKETS.

- A fully integrated, energy efficient new building design can achieve more savings than equipment retrofits. Market forces, however, can fail to bring together the information, labor and capital needed to ensure decision-making that favors economically feasible energy efficient equipment selection and design.
  - Owners — the central decision-makers in CNC projects — are often unaware of the benefits and costs of energy efficient investments, and therefore often perceive little, if any, value in using energy efficient technologies, or design or commissioning services.
  - Architects — central players from design conception through construction, with reasonable knowledge surrounding energy efficiency choices — are discouraged from coordinating efficiency decision-making due to the standard fixed-fee nature of their contracts.
  - All market actors face barriers such as limited capital for investments, lack of information, uncertainty surrounding technology or service-oriented performance, and perceptions of high risk.
- These market issues reflect three fundamental barriers to the use of the best available technologies: emphasis on lowest first cost, reliance on traditional (proven) methods, and lack of market demand for the use of the best available technologies.[1]

[1] Montross, Craig and Fraser, Marion, "Building Design for a Sustainable Future." Proc. ACEEE Summer Conference, 1998.

Exhibit 1-2
Overview of CNC Program Design Activities
and Related Research Objectives



THIS INTEGRATED RESEARCH EFFORT, SPANNING MORE THAN TWO YEARS AND CULMINATING WITH THIS REPORT, WAS UNDERTAKEN TO GAIN AN UNDERSTANDING OF THE USE OF ENERGY CONSERVATION MEASURES IN CNC, AND TO DETERMINE WHETHER, AND HOW, FPL COULD COST-EFFECTIVELY PROMOTE THE USE OF NEW ENERGY-EFFICIENT TECHNOLOGIES IN FLORIDA'S CNC MARKET.

Exhibit 1-2 identifies the research objectives covered in each chapter of the report.

- The results of the business environment-based assessment of the CNC market are presented in Chapter 2. This assessment provides a detailed understanding of the complex business market in which a Commercial New Construction program must operate, so that potentially effective methods for accelerating the adoption of efficient building practices can be examined.

- The third chapter presents the final technical assessment results, including: an assessment of baseline current building practices in FPL's service territory, development and calibration of engineering models to estimate impacts and technical potential, and economic screening of energy conservation measures (ECMs) using the Ratepayer Impact Measure (RIM) and Participant Test.

- Integrated conclusions drawn from the business environment (Chapter 2) and technical (Chapter 3) assessments are presented in Chapter 4. Comprehensive program options such as building design assistance and building commissioning are also discussed.

- The report ends with a discussion of alternative FPL actions and recommendations.

2. BUSINESS ENVIRONMENT

AN ASSESSMENT OF THE COMMERCIAL NEW CONSTRUCTION MARKET WAS CONDUCTED TO PROVIDE AN UNDERSTANDING OF THE BUSINESS ENVIRONMENT IN WHICH ANY COMMERCIAL NEW CONSTRUCTION PROGRAM MUST OPERATE.

- The assessment begins with a discussion of market size, and the key players in the CNC market. Players in this complex market range from such active participants as buyers (owners) or sellers of products (equipment suppliers) and services (architects, engineers, contractors) to players who make the transactions surrounding the new construction process possible (realtors, lenders, appraisers) or establish the regulatory framework within which the process takes place (code enforcement officials).

- The roles of, and relationships among, the key market participants are assessed to help determine where critical decisions regarding energy efficiency are made and how those decisions might be influenced.

- The process by which CNC market actors move from initial awareness of a new technology or practice to its adoption is then described, using the classical product adoption process model as a basis. The final step in the market assessment is examining the current status of key market actors in their movement though the adoption process, so that possible methods for accelerating the adoption of efficient building practices can be examined.

Exhibit 2-1
Estimated CNC Market Size
for Year 2002 Commercial New Construction

Business Type	Annual Square Footage (1,000s)	Annual Number of New Buildings*				Estimated Cost of Energy Efficiency Actions ($1,000s)**					Current CNC Market Total Construction Costs ($1,000)
		Small	Medium	Large	Total	Mandatory and Common Prescriptive Solutions	Other Prescriptive Solutions	Design Assistance	Commissioning	Total	
Office	10,500	1,131	24	14	1,168	6,100	4,400	3,500	4,200	18,200	840,000
Restaurant	1,660	715	8	0	723	1,400	900	500	700	3,500	132,800
Retail	7,070	1,011	19	11	1,041	3,200	5,100	2,300	2,800	13,400	565,600
Grocery	1,670	265	18	13	297	500	1,600	600	700	3,400	133,600
School	3,100	46	20	10	75	1,700	1,800	1,000	1,200	5,700	248,000
College	1,500	16	2	3	21	700	900	500	600	2,700	120,000
Hospital	1,810	0	8	6	13	1,000	900	600	700	3,200	144,800
Hotel/Motel	3,750	120	12	7	139	1,600	800	1,200	1,500	5,100	300,000
Subtotal	31,060	3,304	110	63	3,477	16,300	16,400	10,200	12,400	55,300	2,484,800
Other	21,100	1,195	46	21	1,262	11,100	11,100	7,000	8,400	37,600	1,688,000
Total	52,160	4,499	156	84	4,739	27,400	27,500	17,200	20,900	93,000	4,172,800

* Number of buildings:
- Small customers are those with billing demand less than 200 kW.
- Medium customers are those with a GSD account and billing demand in excess of 200 kW.
- Large customers are those with a GSLD account.

** Estimated costs:
- Design assistance is estimated at $0.33/sqft.
- Commissioning is estimated at $0.40 per square foot.

Notes:
- New construction square footage estimates were derived using EPRI COMMEND.

AS SHOWN IN EXHIBIT 2-1, COMMERCIAL NEW CONSTRUCTION IN FPL'S SERVICE TERRITORY IS A $4 BILLION ANNUAL MARKET, WITH POTENTIAL ENERGY EFFICIENCY-RELATED INVESTMENTS CONSERVATIVELY ESTIMATED AT $90 MILLION PER YEAR.

- Three types of energy efficient actions are included in the estimate of the marginal additional annual energy efficient investments — mandatory and prescriptive solutions, design assistance and building commissioning.
  - Mandatory and prescriptive solutions are energy efficiency products like those that are often included in other CNC programs. Many of these measures are currently included in FPL's C/I sector DSM programs. In addition, other measures identified in the technical assessment but not included in FPL's current C/I sector program, such as dehumidification and HVAC plant upgrades, are included in the estimate of market size.
  - Design assistance can promote the adoption of innovative/advanced energy efficient measures and designs by the design/build team.
  - Building commissioning makes use of a commissioning agent or other qualified professional to review designs, oversee construction and provide functional performance testing of building systems prior to occupancy.
- The cost estimates for mandatory and prescriptive measures were derived during measure screening activities. The costs for design assistance and commissioning are based on the results of a literature review and industry expert input.
- Total construction costs, of $80/sqft, were estimated using F. W. Dodge New Construction Projects Starts data.

GIVEN THESE ASSUMPTIONS, INVESTMENT IN IMPROVED ENERGY EFFICIENCY COULD ADD APPROXIMATELY 2.5 PERCENT TO THE COST OF CNC IN FPL'S SERVICE TERRITORY.

Exhibit 2-2
Commercial New Construction Energy Efficiency Market Actors

END USERS	*PRODUCT & SERVICE SUPPLIERS*	*SUPPORTING PLAYERS*
• Investment Drivers – Owner Occupied .. Sole Occupant .. Occupant/Landlord – Developers .. Build for lease/rent .. Build for sale .. Build on spec – Public Sector • Occupancy – Owner Occupied – Tenant • Type of Application – Large Customer – C/I Parks – Chain Stores .. Centralized decisionmaking .. Decentralized decisionmaking – Strip Malls – "Mom and Pop" Operations • Technology – Large – Small – Grocery • Business Type – Office – Retail – Supermarket – Hotel – Hospital – Other • Needs-Based – Quality Seekers – Low Cost Seekers – Hassle Avoiders – Environmentalist	• Architects – Fixed fee contract – Time & materials contract – Performance-based contract • Engineers • Cx Agents • Building Operators • Contractors – General/Prime Contractors .. Design-build .. Build only – Specialty/Sub- Contractors .. HVAC .. Lighting .. Windows, insulation, etc. – Performance Contractors • Distributors/Wholesalers • Manufacturers • Building Operation – Building Operators – Property Managers	• Financial Institutions • Utilities – Programs .. CNC .. Other – Informational/Promotional vehicles .. Web site .. Media ads .. Pamphlets/bill inserts • Realtors • Appraisers • Building and Planning Departments • Codes and Standards Officials and Consultants • Trade Associations • Government Organizations

AS ILLUSTRATED IN EXHIBIT 2-2, THE COMMERCIAL NEW CONSTRUCTION MARKET INCLUDES A VARIETY OF PLAYERS. THE ROLES OF THESE PLAYERS, AND THE INFLUENCES THAT THEY HAVE IN THE CNC MARKET, ARE EXPLORED IN THIS CHAPTER.

Market actors can be broadly divided into end users, product and service suppliers, and supporting players who make the new construction process and related transactions possible. Each group is discussed below.

- End users can be segmented according to the types of buildings being constructed, the business characteristics of the owner (e.g., standalone operations, franchises, chain stores with centralized or decentralized decision making), and the type of energy using technologies suited to the building (i.e., small, medium, large, grocery).

  - There is a fundamental distinction between owners who intend to occupy the building they are constructing and those who are developing a property to sell or lease the space upon completion.

    .. Relatively few large, integrated real estate firms who act as owners, developers, and property managers play a critical role both in the selection of systems and practices for their own buildings, and also as opinion leaders who help shape the rest of the market's perceptions of the importance of energy efficiency. In addition, a small number of state agencies or departments may have far-reaching influence in the building practices of the public sector.

    .. Owner-occupants typically include larger corporations and government agencies. Government owners, who account for as much as 20-25 percent of new construction, tend to have a long planning horizon and often incorporate energy efficiency into construction practices; the Florida Department of Management Services, for example, has been a leader in the adoption of commissioning. Private sector companies who are building their own facilities usually also have a relatively long planning horizon, and include national players such as leading hotel/resort operators, major retailers like Wal-Mart, and chains, such as McDonald's.

    .. Developers build either with tenants or a buyer pre-arranged, or in the expectation that they will be able to sell the property. Examples include office buildings and strip malls. Because they do not intend to occupy the facilities themselves, developers have a short-term orientation that discourages consideration of energy efficiency measures.

Exhibit 2-3
Market Actors and the New Construction Process

Steps in Construction Process / Market Actors	Determine Project Need and Scope →	Obtain Financing/ Allocate Funds →	Design →	Construction Documents; Permits and Code Compliance →	Construction →	Acceptance →	Post-Acceptance →	Resale
Financier/funding source	○	●						●
Owner/developer	●	●	◒	◒	◒	●	◒	●
Building Occupant/ Operator	●		○			◒	●	◒
Architect	◒	○	●	●	◒	○		
Engineering Designer			●	◒	◒	○		
Code Compliance Consulant			●					
Building Officials	○			●	●	◒		
Construction Prime Contractor				◒	●	●		
Sub-contractors					●	◒		
Commissioning Agents			○	◒	◒	●	◒	
Realtors	○	◒						●
Appraisers	○	◒						●

KEY
● High Importance
◒ Moderate Importance
○ Low Importance

- Product and service suppliers include those players directly involved in the new construction transaction with the end user.
  - Architects retained by the owner are responsible for the overall building design, including siting, fenestration, and layout. Most architects work on a fixed fee per project, although some contracts may be written on a time and materials basis. Performance-based contracts where architects are compensated based on the performance of the completed building, including occupant comfort, are still rare.
  - Engineers design the mechanical systems and verify structural integrity. Some architectural firms incorporate the engineering function themselves, although there are also many firms who do only engineering work. Engineering firms range in size from one-person operations to multinational firms with hundreds of employees.
  - Contractors put up the building, including both prime contractors and various specialty subcontractors responsible for mechanical, electric, and plumbing (MEP) systems.
  - Commissioning agents act as a specialized subcontractor, but typically work directly for the owner to ensure that design intent is achieved. Performance contractors like these are still rare in the new construction market.
  - Manufacturers and distributors/wholesalers have little direct contact with the owner, but they play a vital role in the pricing and availability of various kinds of equipment.
  - Finally, building operators and/or property managers may be retained by the owner to handle the management and day-to-day operations of a building.

- Supporting players provide the commercial or regulatory infrastructure for new construction projects, and act as a source of information on construction best practices.

  - Lenders, commercial realtors and appraisers help to determine the market value of new (and existing) buildings. Their willingness to incorporate energy efficiency as a factor in financing packages, building rents and market resale value could enhance the value of energy efficiency in CNC.

  - Building officials, code compliance consultants, and building inspectors all contribute to the establishment of minimum standards to which the owner and architect must design and build a project.

  - Information providers, including trade associations such as BOMA, ASHRAE, ARI, and AIA, as well as government organizations such as DOE and EPA, influence new construction practices by providing designers and builders with information on standards, procedures, and recent technological advances.

  - Utilities can play an important role as information providers, and have also intervened more directly in the market in other states through programs offering rebates, financing, training, and visible recognition for energy efficiency accomplishment.

INTERACTIONS BETWEEN THESE PLAYERS AS A PROJECT MOVES THROUGH THE NEW CONSTRUCTION PROCESS ARE DISCUSSED ON THE FOLLOWING PAGES.

THE TYPICAL NEW CONSTRUCTION PROCESS — WHICH TAKES UP TO THREE YEARS AND INVOLVES INTERACTIONS BETWEEN END USERS, SUPPLIERS, AND SUPPORTING PLAYERS — IS CENTERED AROUND THE BUILDING OWNER/DEVELOPER, WHO MAKES THE ULTIMATE DESIGN AND CONSTRUCTION DECISIONS.

The roles played by different market actors as a new construction project moves through the stages of the construction process are illustrated in the facing exhibit. Both direct product flows (i.e., those between the buyers and sellers) and enabling services flows (those that facilitate the transaction between buyer and seller in the market) are illustrated, thereby providing a framework for the analysis of potential CNC program interventions.

- Owners and architects interviewed in conjunction with this project describe the typical new construction project as taking up to three years from the time the feasibility of a project is determined until the building is occupied.

  - In the initial pre-design planning phase, the owner determines the feasibility of the project, lines up tenants or a buyer (or determines internal needs), works with an architect to determine the project's scope, and secures funding, either from a lender or from internal sources (such as corporate headquarters or a public financing authority). There may also be interaction with realtors and appraisers (to test the market) and with building officials (to assure compliance with zoning or master plans). This initial phase typically takes about three months, according to the Florida owners we interviewed.

  - The actual design also takes about three months, and is led by the architect, who works closely with engineers and a code compliance consultant as well as the owner to develop a design intent and a set of plans that meet that intent.

  - Once a design has been approved by the owner, it is formalized into a set of construction and code compliance documents that are submitted to building authorities for plan check and approval.

- Actual construction time depends on the building complexity, and takes 6 to 24 months. The prime contractor is the lead player in this phase, with responsibility to ensure that subcontractors perform their assigned projects properly and that inspections by building officials are passed. In addition, the architect and owner both remain involved to ensure that work is going in accordance with the original plan. Some architects note, however, that owners may work directly with the contractor to circumvent the original plan — which may result in buildings that do not meet code.

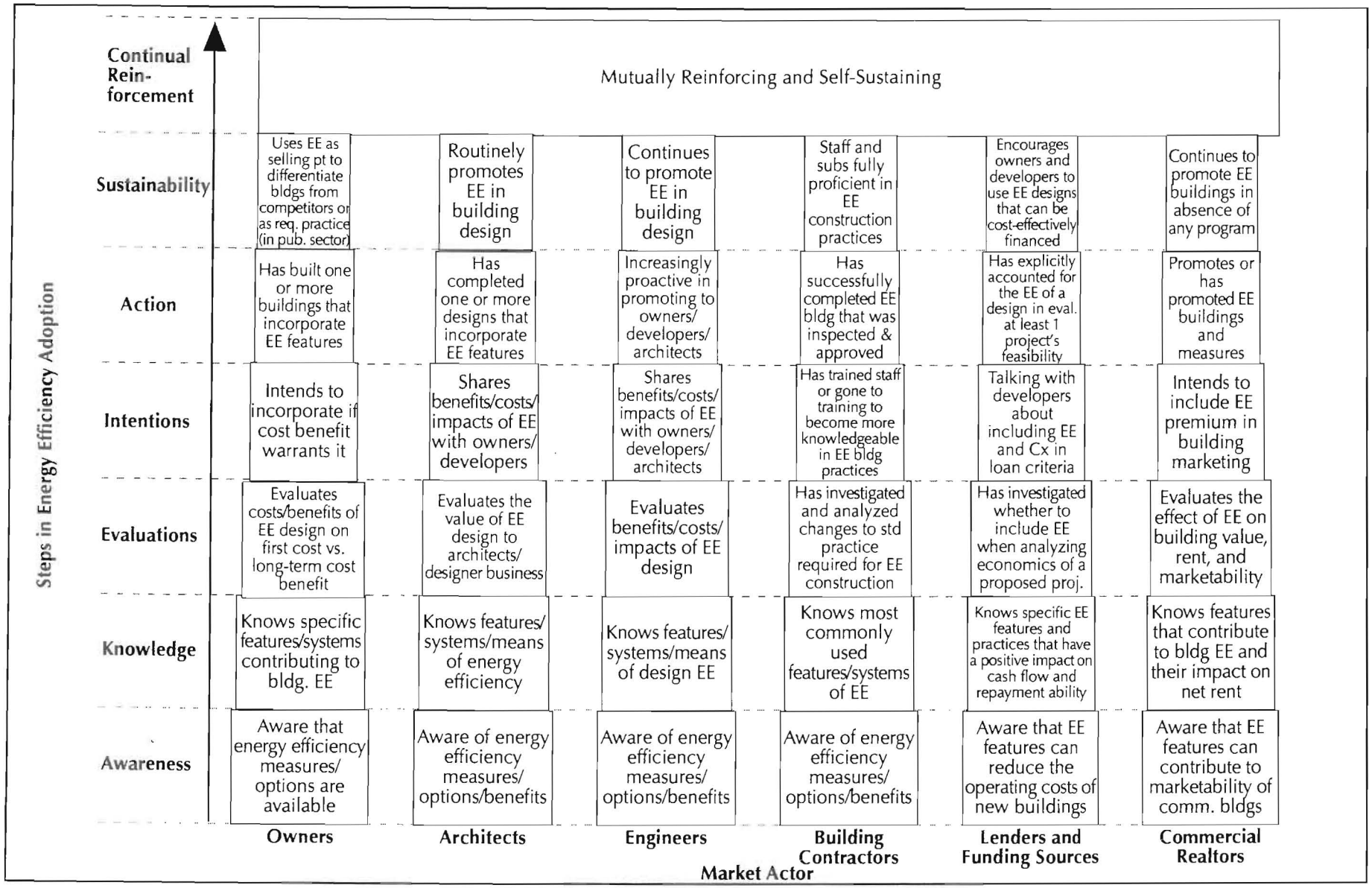
- Acceptance of the completed building by the owner, and occupancy (either by the owner or tenants) mark the acceptance stage. The builder's contract may also call for commissioning of the building by an independent commissioning agent to ensure that all systems are installed and operating properly and that operations and maintenance personnel for the building will have adequate training and documentation.

- The first year after acceptance is usually covered by a warranty. Typically, at least some deficiencies are uncovered, with resulting contractor call-backs. If there is one, the commissioning agent will verify that problems have been rectified.

- The final stage, illustrated in Exhibit 2-3, is the resale of the building. In the case of speculative building this may occur almost immediately after acceptance; or it may occur after the developer has fully leased the building, thereby making the building more marketable. Commercial realtors and appraisers are also involved in this process.

- It is important to note that the market interactions become more complex as public-sector driven initiatives to correct inefficient market behaviors are made. Design incentives provided to architects, for example, affect the relationship between architects and builders as well as that between architects and utilities who previously provided only information. Even the permitting process, which would seem to be peripheral to the success of energy efficient design, has been used by some residential new construction programs to encourage efficient design by providing faster turnaround to builders who agree to exceed the energy code by a given percentage.

Exhibit 2-4
CNC Energy Efficiency Product Development/Adoption Process

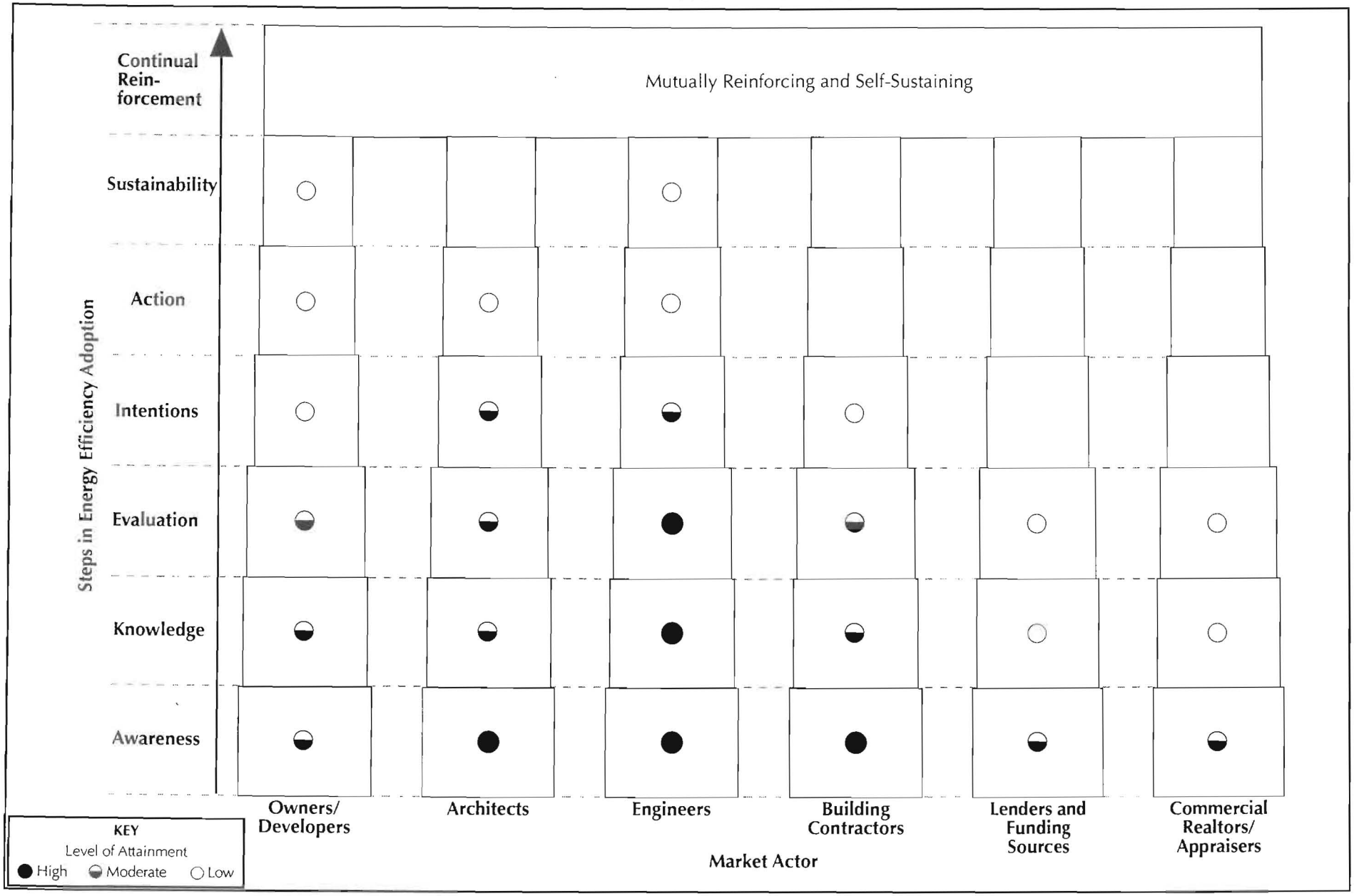


DEVELOPMENT OF A MUTUALLY REINFORCING, SELF-SUSTAINING MARKET FOR ENERGY EFFICIENCY MEASURES IN THE DESIGN AND CONSTRUCTION OF COMMERCIAL BUILDINGS IN FLORIDA WILL REQUIRE THAT MARKET ACTORS MOVE THROUGH INTERMEDIATE STEPS.

- Progress through the intermediate steps is analyzed in the context of the product adoption process model, founded on the observation that market actors move through relatively well defined steps from initial awareness of a new technology or practice to its ultimate adoption, as illustrated in Exhibit 2-4.
  - In the example shown for architects, as for other market actors, progress toward adoption begins with awareness of energy efficient options or programs.
  - Awareness can lead to greater knowledge about specific measures or features, which in turn can lead architects to evaluate the benefits and costs of incorporating energy efficiency into their designs.
  - If the benefits and costs are found to meet the criteria of architects and their clients, a decision may be made to discuss efficient options on the next project as a prelude to actually taking action.
  - Once the architect has developed an energy efficient design, the reaction of owners and other market actors will determine whether the action is repeated and made a part of the architect's standard practice.
  - Ultimately, when all market actors attain this stage, the energy efficient design of new buildings becomes a self-sustaining, mutually reinforcing phenomenon as efficient buildings become the market standard.

- A true transformation of the market will occur only when the key market actors permanently change the way in which they participate in the market to incorporate energy efficiency as standard practice. To cite just a few examples, the following conditions are all part of the "vision" necessary to the attainment of increased energy efficiency as standard CNC practice.
  - Financial institutions, real estate appraisers, and commercial realtors must all explicitly capitalize energy efficiency into the values they assign to CNC buildings.
  - The rental rates charged by building owners and property management firms for commercial buildings should, as a matter of course, incorporate a premium for greater energy efficiency.
  - Building inspectors and the local code authorities they represent should be sufficiently familiar with energy efficiency measures to evaluate their proper installation and operation in a new building.
  - Specialty contractors should be knowledgeable about and willing to adopt energy efficient construction options such as shell measures, advanced mechanical systems, and building commissioning.
- It should be clear, of course, that this process is by no means assured, and that there may well be "show-stoppers" (e.g., costs that outweigh perceived benefits) that prevent market actors from moving to the next stage. At the same time, other barriers that emerge during the movement from one stage to the next can be identified and addressed by appropriate market interventions.

Exhibit 2-5
CNC Energy Efficiency Adoption Process
Status for Various Market Actors



A PRELIMINARY ASSESSMENT OF THE CURRENT STATUS OF KEY PLAYERS IN THEIR PROGRESS THROUGH THE STEPS DESCRIBED ON THE PREVIOUS PAGES PROVIDES AN OVERVIEW OF THE MARKET THAT WOULD BE TARGETED BY A CNC PROGRAM.

The final step in the market assessment — an examination of the current status of key market actors in their movement though the product adoption process — is presented in summary form in Exhibit 2-5.

- As shown in the exhibit, architects and engineers are generally further along in this process than are owners/developers and other, supporting market actors. As a result, it can be assumed that certain designers would be positioned to take advantage of, for example, technical assistance that supports their movement from the evaluation stage to the intentions stage. Similarly, some designers should be well qualified to evaluate the prescriptive, performance-based, and mandatory elements of a CNC program for their clients.
- Lenders and commercial realtors, on the other hand, are only somewhat aware of energy efficient mortgages and construction options. Information/education could possibly help these players move through the awareness and knowledge stages before being confronted with energy efficient options as part of a CNC program.
- Building and specialty contractors occupy a middle ground; they are generally knowledgeable about energy efficiency and have conducted some evaluation of the implications of energy efficient construction on their business. Most have rejected it, however, because they fear they will lose business to lower cost competitors if they offer an energy efficient option.
- There are significant differences in energy efficient-related attitudes and actions among different types of owners between the various segments. Public sector owners are generally more aware of and committed to energy efficiency than are private sector owner-occupants, who are, in turn, far more knowledgeable and interested than speculative builder/developers. These and other differences and their implications for program design are discussed on the following pages.

Exhibit 2-6
Mapping of Intervention Strategies to Segments

Investment Drivers	Applications					Needs				Strategy			
	Large Custom	C/I Parks	Chain Accounts	Strip Malls	Mom & Pop	Quality Seekers	Low First Cost seekers	Life Cycle Low Cost Seekers	Hassle Avoiders	Information	Incentive-based Programs	Design Assistance	Performance Contracting
Owner													
Sole Occupant	●					●				●		●	
									◒	◒			●
			●					●		●	●		◒
									◒	◒	◒		◒
					●		●			●	●		
Occupant/Landlord							●			●	●		◒
	●							●		●	◒	●	●
									◒	◒	○	●	◒
						◒				●	◒	◒	◒
		●					●			●	●		◒
									◒	◒			●
				●			●			◒	●		
									◒	○	○		
Developer													
Build for Lease/Rent	●					●				●	○	●	◒
							◒			◒	●	◒	
								◒		●	◒	●	●
									○	○			◒
		●				◒				●	◒	●	●
							◒			●	●		○
								◒		●	●	◒	●
				●			●			◒	●		
									◒	○	○		◒
Build for Sale	●					●				◒	◒	●	◒
							◒			◒	●		
								○		●	◒	●	●
		●						●		●	◒	●	●
							◒			◒	●	○	
						◒				◒	○	◒	◒
							●			◒	●		◒
					●	●				◒	◒	●	●
									◒	○	○		◒
Build on Spec	●						◒			○	●		
		●					◒			●	●	●	
				●			◒			●	●		
					●		◒			●	●		◒
Public Sector	●							●		●	●	●	●

The incentive-based programs includes mandatory, prescriptive, custom, comprehensive and Commissioning.
Occupant/Landlord segments assume tenant paying utility bills.
Developer Build for Lease/Rent segments assume developer is paying utility bills.

KEY
● High Importance
◒ Moderate Importance
○ Low Importance

THE OVERVIEW MARKET STATUS ASSESSMENT PROVIDES A STARTING POINT FOR MORE DETAILED ANALYSIS OF THE NEEDS AND DRIVERS OF INDIVIDUAL SEGMENTS, AND THEREFORE DIFFERENCES IN POSSIBLE INTERVENTION STRATEGIES.

Exhibit 2-6 illustrates how segmentation can be used to design intervention strategies for specific combinations of investment drivers, applications, and needs. The solid ball under "application" indicates which combination of investment driver and application is being considered; the solid, half, or empty ball under "needs" indicates the level of importance of that segment in the market; and the solid, half, or empty ball under "strategy" indicates the relevance of each strategy for the segment. Since almost all owner/developers are likely to view incentives as a desirable program element, the ranking for "incentive" in this context indicates the extent to which incentives are believed to be necessary for a given segment.

- Information is shown to be an effective strategy for most segments — on the assumption that information will be tailored to the needs of each segment; for example, emphasizing non-energy benefits to quality seekers, long-term savings to life cycle cost minimizers, and low/no-cost measures to low first cost seekers. Only hassle avoiders are expected to have very limited interest in information.

- As noted above, incentives are viewed favorably by all segments, but are most necessary to influence the actions of low first cost seekers.

- Design assistance is likely to be effective for those segments that are inherently motivated to seek out design improvements: generally quality seekers and life cycle cost minimizers. Low first cost seekers are unlikely to respond to any design suggestions (since they would almost inevitably add to first cost), and time-constrained hassle avoiders would generally not want to create any delays in the construction process.

- Performance contracting is an option in segments such as the public sector, where minimizing life cycle cost is often a consideration.

THIS CONCLUDES THE DISCUSSION SURROUNDING THE COMMERCIAL NEW CONSTRUCTION BUSINESS ENVIRONMENT. NEXT, FIELD STUDY AND MODELING RESULTS ARE PRESENTED.

3. FIELD STUDY AND MODELING RESULTS

RESEARCH-BASED MODELING AND FIELD STUDY RESULTS ARE PRESENTED IN THIS CHAPTER.

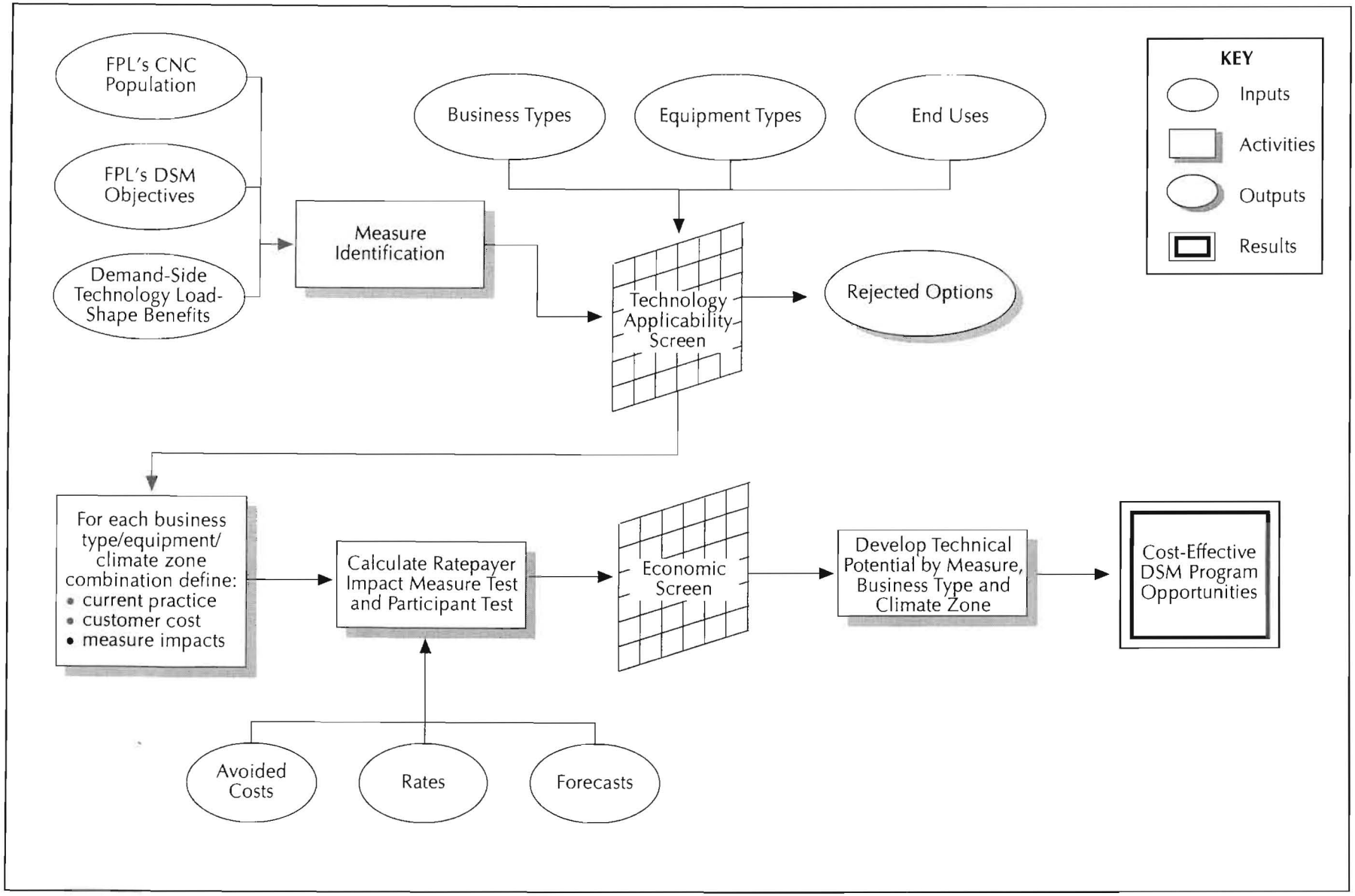
These results are based upon extensive research on new building attributes and energy consumption in FPL's service territory, and the development of new building/end-use models, which served as a platform for assessing technology-specific opportunities for coincident peak demand and annual energy savings.

- Extensive customer-specific data was collected to assess current design and building practices.
  - Submitted Florida Energy Efficiency Code (Code) data were obtained for over 1,500 new building designs in FPL's service territory. These data were used to assess current building practices, both relative to code requirements and in terms of the building characteristics and efficiency levels specified. Very importantly, these results show that buildings are being designed at far above the efficiency levels required by Code. The average Code rating for these buildings is 65, 35 percent more efficient than the required minimum level of 100.
  - Furthermore, 100 on-site audits of buildings included in the Code sample were conducted to assess as-built new building conditions and examine the differences that exist between submitted code-based design attributes and those found in the field. Few differences were found between the field and code for A/C and lighting systems. Tinted and double pane glass was found to be more common than code records indicate. Ceiling/roof insulation, however, was found to be underinstalled relative to submitted documents. This may occur because the Code allows assessment of ceiling/roof compliance using a Whole Building Performance Method "in accordance with the procedures contained within the FLA/COM computer program," which in turn allows designers to specify no ceiling insulation.
  - In addition, whole-premise interval metering data were obtained from 50 new buildings, serving as a source of load shape information for calibration of the models described below.

- Using these data as inputs, DOE-2 cooling, heating and ventilation models, and other end-use models (including lighting and refrigeration) were developed. These models were used to estimate baseline usage levels for typical large and small customers in key business segments, and demand and energy impacts for numerous energy efficiency measures.

- These results were combined with equipment cost estimates and FPL electricity supply and price estimates to assess possible cost-effectiveness of the various measures in a CNC program. These results are presented in the remainder of this chapter.

Exhibit 3-1
Final Program Technical Assessment Procedures



THE ECONOMIC SCREENING PROCESS ILLUSTRATED IN EXHIBIT 3-1 WAS USED TO ASSESS THE POTENTIAL ATTRACTIVENESS OF VARIOUS TECHNOLOGIES.

Measure-specific results are presented by end-use (i.e., cooling, heating, indoor lighting, etc.) and by building component (i.e., non-glass building surfaces, glass building surfaces, etc.)

- Three separate screening criteria were used for this analysis.
  - Ratepayer Impact Measure (RIM) — A RIM score in excess of 1.0 suggests that the present value of avoided costs for generation, transmission and distribution exceeds lost utility revenues. (This analysis usually includes the costs of a DSM program; however, in this case, the measures were assessed without including program costs for each individual measure. Instead, program costs for an overall CNC program that would include several measures were evaluated at the end of the project.)
  - Participant Test — A score in excess of 1.0 suggests that the net present value of the investment is positive for potential participants.
  - Technical Potential — The technical potential of a measure is the maximum possible level of annual savings that could be achieved if all of FPL's customers adopted the measure. These are potential savings over current observed practice (which, as discussed above, already exceeds Code). Technical potential is presented as coincident summer peak hour impacts in this chapter.

- It is important to reiterate that the savings estimates presented incorporate the results of an extensive assessment of baseline new construction building practices in FPL's service territory. That is, all impact and cost-effectiveness estimates are measured relative to current market practice. Furthermore, technical potential accounts for the fraction of new buildings that are already equipped with high efficiency systems.

THIS CHAPTER CONCENTRATES ON THE POTENTIAL SAVINGS REALIZED BY INVESTMENTS IN INDIVIDUAL MEASURES UNDER THE ASSUMPTION THAT OTHER ELEMENTS OF THE BUILDING DESIGN REMAIN UNCHANGED. THESE RESULTS ARE INCORPORATED WITH ESTIMATES OF POTENTIAL BUILDING DESIGN AND COMMISSIONING SAVINGS IN CHAPTER 4.

Exhibit 3-2
Building Envelope Measure Performance

Envelope Component	Measure Description		Measure Performance			Market Conditions
	Baseline	Efficient System	RIM Test Score for GSD	PART Test Score for GSD	Summer Demand Technical Potential (kW)	
Exterior Walls	Concrete wall, R-4.95 rigid insulation, composite U-value = 0.16, no framing	Concrete wall, R-11 rigid insulation, composite U-value = 0.08, no framing	4.67	0.08	1,570	Concrete block walls are the predominant type in new construction, and are normally insulated to R-5. There is an opportunity to upgrade from 1" of polystyrene insulation to 2", with relatively high benefits for small buildings. However, incentives would be needed to improve customer payback.
Ceiling/Roof	R-10 fiberglass insulation	R-19 fiberglass insulation	1.47	1.25	1,707	Ceiling and roof assemblies are on average insulated to R-10, and there is evidence that some assemblies are uninsulated in the C/I new construction segment. Adding fiberglass batt insulation is relatively inexpensive, so payback above R-10 is reasonable. For those buildings without insulation, payback would be very rapid.
		R-30 fiberglass insulation	1.42	0.79	2,710	
Ceiling/Roof	R-10 rigid insulation	R-19 rigid insulation	1.30	0.34	433	Adding rigid insulation is a more expensive upgrade, and payback above R-10 is poor. For those buildings without insulation, payback would be more reasonable. First cost is a clear barrier to the addition of roof insulation, and incentives would probably do little to improve payback for the general R-10 baseline population.
		R-30 rigid insulation	1.32	0.25	636	
Roof Surface	Medium roof color (solar reflectance = 15%)	Light roof color (solar reflectance = 25%)	1.09	0.50	254	Incremental costs and thus payback are high for light shingles, and prohibitive for roof painting. Calculations assume an incremental cost of $0.10/sqft for light shingles.
		Painted white roof (solar reflectance = 70%)	1.05	0.34	2,432	
HE Commercial Glazing	Clear, single pane glazing, SC = 1.0	Standard tinted single pane glazing (SC=0.6)	1.02	3.13	2,169	Single pane clear glass is still commonly installed in many small buildings, while tinted glass is more frequently installed in larger buildings.
		Bronze tinted single pane glazing (SC=0.3)	1.03	2.75	3,934	
		Standard tinted double pane glazing (SC=0.5)	1.12	1.41	2,860	
		Bronze tinted double pane glazing (SC=0.2)	1.09	1.41	4,657	
HE Commercial Glazing	Tinted, single pane glazing, SC = 0.60	Bronze tinted glazing (SC=0.3)	0.98	2.13	2,283	There is additional room to move the market towards glass with a very low shading coefficient.
		Standard tinted double pane glazing (SC=0.5)	1.66	0.27	997	
		Bronze tinted double pane glazing (SC=0.2)	1.12	0.68	3,169	
HE Commercial Glazing	Clear, single pane glazing, SC = 1.0	Double pane clear glazing	1.31	0.38	800	Glazing upgrades that specifically improve the glass assembly U-Value are less effective than shading coefficient improvements in the hot Florida climate.
		Low-E glazing	1.91	0.15	985	

BUILDING ENVELOPE MEASURES HAVE THE HIGHEST RIM SCORES, AND THEIR TECHNICAL POTENTIAL IS COMPARABLE TO EQUIPMENT-BASED MEASURE UPGRADES. PARTICIPANT TEST RESULTS, HOWEVER, VARY SUBSTANTIALLY BY MEASURE.

As shown in Exhibit 3-2, two measure groups have attractive Participant Test scores — fiberglass ceiling insulation upgrades, and upgrades from single pane clear windows to tinted high efficiency glass.

- Although most new buildings are constructed with an adequate level of ceiling/roof insulation, there are still some new buildings being built with little or no ceiling/roof insulation. On average, new buildings have R-10.

- The upgrading of all single pane clear glass to single pane bronze tinted would result in 3.9 MW of summer demand reduction per year.

Exhibit 3-3
HVAC Measure Performance

Plant Component	Measure Description		Measure Performance			Market Conditions
	Baseline	Efficient System	RIM Test Score for GSD	PART Test Score for GSD	Summer Demand Technical Potential (kW)	
Chillers	Baseline efficiency water-source chiller (0.8 kW/ton)	Efficient water-source chiller (0.67 kW/ton)	1.04	1.86	2,059	On average baseline air-source chillers are 1.23 kW/ton and water-source are 0.80 kW/ton. Modeled impacts are based on typical chiller improvements achieved in the FPL C/I HVAC program. From a feasibility standpoint there are opportunities to improve efficiency levels more dramatically, especially for water-source chillers with kW/ton ratings well below 0.60.
	Baseline efficiency air-source chiller (1.23 kW/ton)	Efficient air-source chiller (1.10 kW/ton)	1.04	1.80	585	
Chillers	Baseline efficiency water-source chiller (0.8 kW/ton)	Efficient water-source chiller (0.67 kW/ton) and VSD unloading on the compressor motor	1.02	1.12	1,285	Although this measure is expensive, payback is reasonable. Additional technical potential can be achieved using this measure over traditional chiller upgrades.
Chilled Water Pumps	Standard efficiency NEMA motors on chilled water and condenser pumps	Premium efficiency NEMA motors on chilled water and condenser pumps	1.02	12.04	138	While incremental cost is unknown for the primary/secondary VAV chilled water pumping system, the RIM ratio is good and the technical potential is solid for this measure. High efficiency motors to drive chilled water pumps are relatively inexpensive, so payback is rapid.
	Constant volume pumping for the chilled water, three-way valves on all chilled water coils	Constant volume primary loop, variable volume secondary loop, two-way valves on chilled water coils	1.01	NA	1,435	
Cooling Towers	Standard efficiency motors on cooling tower fans	High efficiency motors on cooling tower fans	1.04	6.29	74	High efficiency motors for tower fans are relatively inexpensive, and payback is rapid.
Cooling Towers	Baseline towers (12 deg F tower design approach temperature)	Oversized towers (6 deg F tower design approach temperature)	1.02	1.92	858	Oversized towers are designed to improve chiller performance, and provide a clear advantage over VSD tower measures since summer demand impacts are achieved under design conditions. Payback is also solid.
Packaged Air-Conditioning Systems	Standard efficiency air-source DX units < 65,000 Btuh (10.4 SEER)	High efficiency air-source DX units < 65,000 Btuh (12.2 SEER)	2.07	UTD	0	On average baseline air-source equipment ratings are 10.4 SEER for small equipment and 9.4 EER for medium and large systems. Modeled impacts are based on typical DX improvements achieved in the FPL C/I HVAC program; 12.2 SEER for small, 10.8 EER for medium, and 10.3 EER for large packaged equipment. From a feasibility standpoint there are opportunities to improve efficiency levels more dramatically, especially for small equipment with SEER ratings of up to 16 SEER. With this opportunity to improve efficiency levels beyond those modeled here, the technical potential could be improved substantially.
	Standard efficiency air-source DX units > 65,000 Btuh and < 135,000 Btuh (9.4 EER)	High efficiency air-source DX units > 65,000 Btuh and < 135,000 Btuh (10.8 EER)	0.61	UTD	533	
	Standard efficiency air-source DX units > 135,000 Btuh (9.4 EER)	High efficiency air-source DX units > 135,000 Btuh (10.3 EER)	1.00	0.12	296	
Dehumidification	Baseline chilled water plant	Enhanced plant through passive desiccant	0.00	0.00	N/A	The RIM test for these measures is marginal, and the payback is marginal to poor; for run around coils, the incremental costs are unknown. Technical potential is substantial for these dehumidification measures, as market penetration of these technologies is limited. There may be significant market barriers to adoption, on both the supply- and demand-side.
		Low temperature air distribution	0.97	100.00	1,725	
		Water or refrigerant loop that move sensible heat from the mixed air to the supply air	0.97	NA	3,561	
Ventilation	Constant volume supply air	Variable air volume (VAV) system	0.84	NA	573	VAV systems provide significant energy savings, but not demand impacts. Incremental costs are unknown. This measure already has wide acceptance in the market.
Ventilation	Baseline efficiency fan motors	High efficiency fan motors	0.94	17.33	550	Motor efficiency upgrades for fans provide favorable demand-to-energy impact profiles. However, lengthy payback makes the investment cost prohibitive.

BOTH CHILLER AND PACKAGED AIR-CONDITIONER EFFICIENCY UPGRADES HAVE ATTRACTIVE RIM AND PARTICIPANT TEST SCORES, AND RELATIVELY HIGH LEVELS OF TECHNICAL POTENTIAL.

- As illustrated in Panel A of Exhibit 3-3, the chiller replacement actions covered by FPL's current C/I HVAC program have attractive RIM and Participant Test scores, and relatively high technical potential. Other central plant measures, such as cooling towers and chilled water pumps, have good RIM and Participant Test scores, but lower technical potential.

- Similarly, packaged air-conditioning efficiency upgrades consistent with C/I HVAC program offerings are the most attractive offerings among packaged AC, dehumidification and ventilation options.

  - Packaged AC upgrades have attractive RIM scores and favorable Participant Test scores, as well as high technical potential. Furthermore, since technical potential is based on typical DX improvements achieved in the C/I HVAC program, even higher impacts are possible.

    .. For example, the technical potential presented in Exhibit 3-3 for small AC systems is based on an efficiency improvement from 10.4 to 12.2 SEER (the average efficiency level in the C/I HVAC program), but 16 SEER equipment is available on the market.

    .. The technical potential for 16 SEER small packaged systems is 7.1 MW, versus 3.0 MW under the assumptions used in Exhibit 3-3. Of course, the RIM and Participant Test results would need to be reassessed under the higher SEER assumption.

  - Dehumidification equipment offers high technical potential, and a marginal RIM score. Dehumidification measures face major barriers due to low awareness and high incremental cost.

  - Regarding the ventilation measures, variable air volume (VAV) systems have low RIM scores, as they provide significant energy savings, but relatively low demand impacts. Summer demand technical potential is marginal for the ventilation measures. The cost of high efficiency fan motors to too high relative to potential customer bill savings to pass the Participant Test.

Exhibit 3-4
Indoor Lighting Measure Performance

Lighting Component	Measure Description		Measure Performance			Market Conditions
	Baseline	Efficient System	RIM Test Score for GSD	PART Test Score for GSD	Demand Technical Potential	
General Indoor Lighting	Fixtures with T12 or ES lamps and magnetic ballasts	Fixtures with T8 lamps and electronic ballasts	0.98	> 1	4,258	While the C/I new construction market has room for additional transformation of general building lighting systems, the paybacks are already very favorable, even in the absence of incentives. The RIM scores are marginal. There is a demonstrated need for additional transformation within smaller buildings; in contrast, most larger customer markets are already transformed.
	Fixtures with T12 lamps and magnetic ballasts	Fixtures with T12 lamps and electronic ballasts	0.97	> 1	1,725	
	Fixtures with 3-T12 lamps and no reflectors	Fixtures with 2-T12 lamps and specular reflectors	0.97	> 1	3,561	
	Fixtures with 3-T8 lamps and no reflectors	Fixtures with 2-T8 lamps and specular reflectors	0.92	9.88	3,383	
	Fixtures with incandescent lamps	Fixtures with CFL lamps	0.92	8.12	4,487	
Indirect Entrance Lighting and Other Specialized Uses	Baseline efficiency entrance way or display lights	T5 lighting	0.84	5.28	573	There is a niche CNC market for T5's in specialized applications. FPL could assist in growing this market, though the RIM score of this measure is low.
Exit Signs	Exit signs with incandescent lamps	Exit signs with CFL lamps	0.89	11.35	91	While the C/I new construction market has room for additional transformation of the exit sign market, the paybacks are already very favorable, even in the absence of incentives. The RIM score is low.
		Exit signs with LED lamps	0.89	4.70	113	
Specialized Indoor Lighting Applications	Manual lighting controls for T12 lighting applications such as closets and bathrooms	Delay timer for T12 lighting applications such as closets and bathrooms	0.86	4.19	231	There is limited technical potential for these technologies, since they are recommended only for specific indoor lighting applications. The RIM score is low. Payback is already adequate for these technologies to gain market acceptance on their own.
	Manual lighting controls for T8 lighting applications such as closets and bathrooms	Delay timer for T8 lighting applications such as closets and bathrooms	0.86	2.84	239	
	Manual lighting controls for T12 lighting in individual offices	Wall mounted occupancy sensor for T12 lighting in individual offices	0.86	1.88	193	
	Manual lighting controls for T8 lighting in individual offices	Wall mounted occupancy sensor for T8 lighting in individual offices	0.86	1.28	276	
	Manual lighting controls for T12 lighting in conference rooms	Ceiling mounted occupancy sensor for T12 lighting in conference rooms	0.86	3.14	137	
	Manual lighting controls for T8 lighting in conference rooms	Ceiling mounted occupancy sensor for T8 lighting in conference rooms	0.86	2.13	164	

CONVENTIONAL INDOOR LIGHTING MEASURES, SUCH AS THOSE PRESENTED IN EXHIBIT 3-4, HAVE HIGH TECHNICAL POTENTIAL AND ATTRACTIVE PARTICIPANT TEST SCORES, BUT MARGINAL RIM SCORES.

- T8 and hard-wired CFL fixtures provide potential for 6.5 MW of summer peak demand reduction in a single year of construction. This 6.5 MW figure is derived based on the assumption that only a portion of the incandescent fixtures would be replaced with *hard-wired* CFL fixtures (that is, hallway fixtures would be replaced, but desk lamps would not be replaced).
  - In addition, delamping of T8 fixtures and the installation of specular reflectors could provide an additional 3.4 MW of savings (from a technical potential perspective).
  - Given current market conditions T8 lighting installations should most likely be a requirement under the Florida Energy Efficiency Code for long-tube fluorescent applications.
- T5 fixture installations in specialized applications such as lobby lighting and display lighting have a low RIM score, but a high Participant Test score. Furthermore, there are applications of T5 fixtures in place of traditional HID technologies.
- High efficiency exit signs — both CFL and LED — have high Participant Test scores and are rapidly becoming standard practice. Because they are operated 24 hours a day, exit signs will not pass the RIM test.
- Indoor lighting controls have low RIM scores and limited technical potential.

Exhibit 3-5
Refrigeration and Water Heating Measure Performance

Plant Component	Measure Description		Measure Performance			Market Conditions
	Baseline	Efficient System	RIM Test Score for GSD	PART Test Score for GSD	Demand Technical Potential	
Refrigeration Displays	Current market practice	Install strip curtains in walk-in cooler doors	0.82	4.02	70	Strip curtains are already highly accepted in the large chain grocery market, though there may be additional room for intervention efforts in the convenience store and restaurant business types.
Refrigeration Displays	Medium temperature dual-pane glass doors with anti-sweat heaters	Dual pane glass doors with reduced or no door heat	0.89	0.75	10	The long payback on this measure, combined with the relatively low RIM score and limited technical potential, does not warrant further consideration of this measure.
	Low temperature triple-pane glass doors with anti-sweat heaters	Triple pane glass doors with reduced or no door heat	0.89	0.96	191	
Refrigeration Displays	Standard displays w/ uncontrolled anti-sweat heaters	Standard displays w/ anti-sweat heater controls	0.88	5.72	435	Wide market acceptance, rapid payback and reasonable technical potential are qualities of this measure that suggest it would make a desirable investment. Unfortunately, however, consistent with all of the refrigeration measures, the RIM score is low.
Refrigeration Compressors	Conventional compressor system using several large compressors	Multiplex compressor system	0.88	2.33	343	There is still a significant opportunity to influence the market for these measures, especially ASD compressors. A lot of wasted compressor use during part load could be saved.
		Conventional compressor system with VSD motor controls	0.87	1.33	348	
Refrigeration Condensers	Baseline air-source condenser w/ a conventional condensate temperature setpoint	Lower condensate design temperatures (using evaporative condensers)	0.75	5.51	0	This technology is already accepted within the general grocery design market, although there is some uncertainty surrounding its applicability in the humid Florida climate. Payback is very competitive.
Water Heating Equipment	Conventional electric resistance storage water heaters	Waste heat recovery from a grocery refrigeration plant	0.90	NA	58	There is already significant market penetration for heat recovery within the grocery segment. Based on the RIM score, the attractiveness of this measure limited.
Water Heating Equipment	Conventional electric resistance storage water heaters	Heat pump water heaters	0.87	0.74	1,330	The measure has reasonable technical potential, however, the RIM score and PART test are low.
Water Heating Equipment	Conventional electric resistance storage water heaters	Solar assisted hot water system	0.89	0.45	1,545	Solar water heaters, while too expensive to install, offer substantial technical potential. The barriers are numerous.
Hot Water End-Use Equipment	Baseline showerheads	Low flow showerheads	0.75	>1	53	Tailored for use in the hotel/motel segments only, there are barriers too substantial to overcome in this highly service-oriented segment.

WHILE INVESTMENTS IN HIGH EFFICIENCY HOT WATER SYSTEMS APPEAR TO BE UNDESIRABLE FROM A CUSTOMER PERSPECTIVE, SOME REFRIGERATION MEASURES ARE ATTRACTIVE FROM A CUSTOMER PERSPECTIVE. HOWEVER, AS SHOWN IN EXHIBIT 3-5, NONE OF THE REFRIGERATION OR WATER HEATING MEASURES PASS THE RIM TEST.

- There are a range of available refrigeration-related technologies applicable to the supermarket sector that offer good paybacks from a customer perspective, but often do not pass the RIM criterion.
  - On refrigerated displays, strip curtains in walk-in cooler doors and anti-sweat heater controls offer attractive paybacks.
  - Similarly, multiplex or ASD compressors and/or lower condensate design temperatures offer savings in central refrigeration plant energy use, but have little impact on demand.
- Regarding the water heating options, low-flow showerheads, for example, offer a rapid payback on a small initial investment, but are likely to be resisted by the hotel/motel segment due to customer preferences. Again, none of the water heater measures examined pass the RIM test.

THE RESULTS OF THIS TECHNICAL ASSESSMENT AND THE ANALYSIS OF THE CNC BUSINESS ENVIRONMENT IN CHAPTER 2 ARE INTEGRATED IN THE NEXT CHAPTER.

4. CONCLUSIONS FROM RESEARCH AND MODELING

INTEGRATED CONCLUSIONS DRAWN FROM THE BUSINESS ENVIRONMENT (CHAPTER 2) AND TECHNICAL (CHAPTER 3) ASSESSMENTS ARE PRESENTED IN THIS CHAPTER. COMPREHENSIVE PROGRAM OPTIONS SUCH AS BUILDING DESIGN ASSISTANCE AND BUILDING COMMISSIONING ARE ALSO DISCUSSED.

- Major conclusions are summarized below.
  - Business Environment — In general, as shown in Chapter 2, the number of players involved in the new construction market makes it extremely difficult to sell a CNC program because too many parties have to be convinced to make the sales cycle efficient. Also, based on FPL's experience with the residential BuildSmart program and the experiences of utilities and energy conservation agencies across the country, builders are more likely to want to spend marginal dollars on visible features, like upgraded tile, rather than invisible features, like energy conservation measures.
  - Technical Research on Energy Conservation Measures — As discussed in Chapter 3, the Florida Energy Efficiency Code is not encouraging the use of the latest technologies, since builders are easily passing its requirements. Despite this, as discussed in the remainder of this chapter, a number of measures have the potential to be included in a CNC program.
- The measures that could be included in mandatory, prescriptive and comprehensive program approaches are discussed in the remainder of this chapter. Mandatory and prescriptive approaches would be applicable to all market segments. The comprehensive approaches would be applicable primarily to larger customers.

GIVEN THE COMPLEXITY OF THE SMALL-TO-MID SIZE CNC MARKET, THE ONLY CNC PROGRAM APPROACH THAT MIGHT POSSIBLY BE SUCCESSFUL WOULD BE TO IMPLEMENT A COMBINED MANDATORY MEASURE AND PRESCRIPTIVE PROGRAM. USE OF THE MANDATORY MEASURES WOULD BE A REQUIREMENT TO GAIN ACCESS TO INCENTIVES BEING PAID FOR PRESCRIPTIVE MEASURES. EXPERIENCES FROM PAST CNC PROGRAMS AND OTHER PROGRAMS AT FPL (AND OTHER UTILITIES) HAVE SHOWN THAT THERE ARE INHERENT OBSTACLES TO OBTAINING SIGNIFICANT MARKET PENETRATION AND IMPACT LEVELS FROM CUSTOMERS IN THESE SECTORS.

Measures that are cost-effective in the absence of incentives — primarily code compliant ceiling/roof insulation, and certain indoor lighting applications, could be classified as mandatory measures.

- Ceiling/Roof Insulation — Audit-based baseline results indicate that inspectors sometimes fail to ensure that the minimum ceiling/roof insulation levels allowed under Code are installed. (Ceilings/roofs must be insulated to an R-value of at least R-10 under Code Section 404.1.ABCD.1.) Furthermore, analysis of FLA/COM-submitted code compliance records, suggest that Method A performance calculations are completed with insulation levels that are below the minimum R-10 prescriptive requirements. Education and inspection efforts (through existing programs) could enhance compliance.

- Indoor Lighting — T8 lighting systems, reflector systems and compact fluorescent fixtures are now commonplace in the new construction market. Incentives are not, however, needed for these technologies, as paybacks on the investments are short.

  - Baseline results indicate that penetration of these technologies can be low in some segments, especially in the small building, speculative and rental property markets. The technical potential for these applications represents approximately 9 percent of building summer coincident peak hour demand.

  - To make any possible CNC program as customer-friendly as possible, it is likely that only the T8 lighting system requirement would be strictly enforced. The benefits of compact fluorescent fixtures and reflector systems could be promoted, but installation would probably not be mandatory. Promoting LED exit lights would also be considered.

INCENTIVES FOR SELECTED BUILDING ENVELOPE AND HVAC OPTIONS IN THE NEW CONSTRUCTION MARKET COULD BE JUSTIFIED BASED ON RIM AND PARTICIPANT TEST SCORES. THE MOST ATTRACTIVE TECHNOLOGIES ARE ALREADY INCLUDED IN FPL'S EXISTING PROGRAMS.

- The 15 (out of 68 studied) new construction measures with the highest summer demand technical potentials are already included in FPL's DSM programs. These 15 measures include high efficiency air-conditioning systems, indoor lighting measures, ceiling/roof insulation, and window improvements. Relevant measures included in FPL's existing programs are:

  - HVAC

    .. Thermal energy storage
    .. High efficiency air-source air conditioners
    .. High efficiency packaged terminal air conditioners
    .. High efficiency central plant chillers

  - Indoor Lighting — High efficiency indoor lighting technologies.

  - Building Envelope

    .. Ceiling/roof insulation
    .. Low shading coefficient tinted, bronzed and reflective glass

- Additional measures that are not currently included in FPL's programs but might be included in a prescriptive program approach include dehumidification and HVAC plant upgrades (towers, pumps and fans).

Exhibit 4-1
Estimated Program Summer Demand Technical Potential for One Year of Commercial New Construction

Business Type	Square Footage (1,000s)	Mandatory and Common Prescriptive Measure Technical Potential Results (kW)						Other Prescriptive Measure Technical Potential Results (kW)				Technical Potential Results (kW)					Current CNC Market Summer Peak Hour Usage (kW)
		Mandatory Lighting Upgrades	Ceiling/Roof Insulation Enforcement	Window Upgrades	Chiller Upgrades	Packaged A/C Upgrades	Total	Light Colored Roof	Other Plant Upgrades	Dehumid-ification	Total	Mandatory and Common Prescriptive Solutions*	Other Prescriptive Solutions*	Design Assistance**	Commis-sioning***	Total	
Small Office	5,230	2,168	452	1,951	-	2,037	6,608	505	-	-	505	6,278	480	2,269	575	9,603	15,130
Large Office	5,270	1,124	47	493	1,089	559	3,312	61	1,147	980	2,188	3,147	2,079	2,716	580	8,521	18,106
Restaurant	1,660	1,478	157	808	-	1,100	3,543	145	-	-	145	3,366	138	3,545	183	7,232	23,633
Small Retail	3,630	2,635	289	1,240	-	1,449	5,613	355	-	-	355	5,333	337	2,201	399	8,269	14,672
Large Retail	3,440	1,486	476	60	312	754	3,088	807	102	238	1,147	2,934	1,090	1,819	378	6,221	12,126
Grocery	1,670	873	157	154	-	267	1,451	264	-	-	264	1,379	251	2,415	184	4,228	16,101
School	3,100	433	318	391	476	375	1,994	318	386	-	704	1,895	669	940	341	3,845	6,265
College	1,500	263	13	140	249	225	890	17	262	217	496	846	471	481	165	1,963	3,208
Hospital	1,810	645	48	127	518	53	1,389	55	395	468	918	1,319	872	1,625	199	4,015	10,830
Hotel/Motel	3,750	1,021	183	853	-	1,203	3,260	159	-	-	159	3,097	151	1,698	413	5,359	11,320
Subtotal	31,060	12,128	2,140	6,217	2,644	8,021	31,150	2,686	2,293	1,903	6,882	29,593	6,538	19,708	3,417	59,255	131,390
Other	21,100	8,239	1,454	4,224	1,796	5,449	21,161	1,825	1,557	1,293	4,675	20,103	4,441	13,389	2,321	40,254	89,257
Total	52,160	20,367	3,593	10,441	4,439	13,471	52,311	4,511	3,850	3,196	11,557	49,696	10,979	33,097	5,738	99,509	220,647

* The total contributing technical potential from prescriptive measures is estimated to be reduced by five percent due to interactive effects.

** Assumes that, in addition to prescriptive and comprehensive measure solutions, an additional 15 percent of demand can be saved through design enhancements.

*** Commissioning peak demand savings are estimated using results from an LBNL source, 11 Watts/sqft on average.

AS ILLUSTRATED IN EXHIBIT 4-1, THE ESTIMATED SUMMER PEAK DEMAND TECHNICAL POTENTIAL FOR THE MANDATORY AND PRESCRIPTIVE MEASURES DISCUSSED IN THIS CHAPTER IS 52 MW FOR COMMON MEASURES, REPRESENTING 24 PERCENT OF ANNUAL CNC ELECTRICITY USAGE IN FPL'S SERVICE TERRITORY. OTHER, LESS COMMON, PRESCRIPTIVE SOLUTIONS HAVE THE POTENTIAL TO PROVIDE AN ADDITIONAL 12 MW IN LARGER BUILDINGS.

- As discussed previously, most of the mandatory and prescriptive measures discussed are included in FPL's existing DSM programs. Although not explicitly incorporated in Exhibit 4-1, additional potential is available through the thermal energy storage (TES) and load control elements of FPL's existing programs.

- Additional opportunities — design assistance and commissioning — exist primarily for more complex (and normally larger) building designs and for chain accounts. These programs often require extensive utility involvement and administrative expenses.

  - There are opportunities to modify the overall design using design assistance. Based on the research conducted in this project, design assistance could offer roughly another 15-20 percent in savings.

  - Lastly, a review of the literature indicates that building commissioning (Cx) provides an opportunity for at least an additional 3 percent savings, in addition to non-energy benefits.

RECOMMENDATIONS ARE PRESENTED IN CHAPTER 5.

5. RECOMMENDATIONS

THE BEST APPROACH FOR FPL TO TAKE AT THIS TIME IS TO RELY ON ITS EXISTING PROGRAMS TO CONTINUE TO STIMULATE ENERGY EFFICIENCY ACTIONS IN THE CNC MARKET AND TO PREPARE EDUCATIONAL MATERIALS TO HELP STIMULATE MORE FREQUENT USE OF CERTAIN MEASURES THAT WOULD BE ECONOMIC WITHOUT A SUBSIDY PROGRAM.

- Currently, new construction is included in the C/I HVAC program. Inclusion of new construction in the C/I Lighting program is not recommended, as T8 fixtures are standard practice in new construction in FPL's service territory. Other measures identified as possible candidates for a CNC program (such as chilled water pumps and cooling towers) are periodically considered for inclusion in FPL's C/I sector programs.
  - The CNC market may be included as part of the eligible program market if subsequent assessments indicate that these measures should be added to the existing programs.
  - However, it is important to consider differences between the CNC and retrofit markets when making decisions about adding eligible technologies to FPL's programs or including CNC applications.
    - Programs designed for existing buildings can ensure that the implemented measure will actually save energy, since eligibility requires a change from what already exists.
    - However, class-by-class adoption of individual measures cannot ensure that an improvement in efficiency would result in new construction applications, since the builder could (for instance) take an air conditioner subsidy and simultaneously cut back on window efficiency. This would not be a problem if the builders had to stretch to meet Code requirements; however, since most buildings already easily meet Code, it would be very difficult, if not virtually impossible, for FPL to prevent free riders with this approach.
- This work has identified several measures (T-8 lights, bronze-tinted windows, R-19 ceiling/roof insulation, high-efficiency A/C systems) that are not utilized as often as they could be in Florida, and that would be economic for C/I new construction even without a DSM subsidy. FPL should prepare educational materials that could encourage the CNC market to use these measures more frequently.

Exhibit 5-1
Projected Stand-Alone CNC Program Performance

FPL Program Approach	FPL Program Component*	Estimated Annual FPL Full Scale Program Participants	Annual FPL Full Scale Program Demand Reduction (kW)	Annual FPL Full Scale Program Budget ($)	Annual FPL Full Scale Program Cost per kW ($/kW)
Mandatory/Prescriptive	Common Prescriptive Only	30	9,909	2,006,154	202
Comprehensive	Common Prescriptive + OPS	40	1,779	97,778	55
	Common Prescriptive + OPS + DA	60	2,475	1,135,402	459
	Common Prescriptive + OPS + Cx	30	215	150,000	699
TOTAL		160	14,376	3,389,333	236

* OPS, Other Prescriptive Solutions, are pre-qualified measures that fall outside of the more common offerings of FPL's existing programs.
DA, Design assistance.
Cx, building commissioning services.

DEVELOPMENT OF A STAND-ALONE CNC PROGRAM IS NOT RECOMMENDED.

- Developing a stand alone CNC program that would require the use of certain measures via a combined mandatory/prescriptive approach would maximize program benefits and allow for comprehensive review of building designs (and operation).
  - As shown in Exhibit 5-1, a mature stand-alone CNC program could provide 14 MW of summer peak demand savings at an annual cost of $3.4 million, or approximately $240/kW, excluding startup costs and assuming 14% market penetration.
  - However, there are large startup costs (approximately $500,000 over 2 years) associated with planning and implementing a CNC program, and it would take more than two years before a full-scale program could be launched.
    - Approximately one year of planning and development would be needed before a CNC Pilot program could be launched.
    - The pilot program would run for approximately one-and-a-half years, at which point FPL and the FPSC would make a decision regarding whether or not to proceed with a full-scale program.
    - After the internal decision to proceed is reached (three months), FPSC approval of the full-scale program would be sought (another three months).
    - In addition to the large startup costs and long startup time, experiences with other CNC programs show that there is considerable uncertainty as to the program's ability to acquire enough customers to provide meaningful impacts. It would be more economic for the ratepayer to add capacity to the system, at a marginal cost of $250-$300/kW, rather than attempting to reduce demand with a standalone CNC program. The marginal generation capacity would have a known result at a known cost, while the standalone program would have an uncertain result which, even in the best case, would have a similar cost, excluding startup costs. Therefore, this approach is not recommended.

6. BUDGET

THE BUDGET AND EXPENDITURES FOR THE PROJECT ARE SHOWN BELOW.

- The budget and expenditures for each phase of the program were as follows:

Project task	Budget	Actual expenditures
Phase 1: Literature search and project management	$175,000	$196,498
Phase 2: ECM simulation models and economic analysis	$300,000	$323,859
Phase 3: Field research	$750,000	$419,225
Phase 4: Market study and program design	$300,000	$221,791
Total project	**$1,525,000**	**$1,161,373**

- Phases 1 and 2 were slightly over budget because more ECMs were identified than had been anticipated before the project started. This resulted in a longer literature search and extended the time required to develop the simulation models.

- Phase 3 was under budget because, during Phase 2, we were able to reduce the cost of the field study.

- Phase 4 was also under budget because our consultant was able to draw on their previous experience in the C/I new construction market to complete the market study faster than had been anticipated when the budget was prepared.

- The net result is that the project was completed under budget by $363,627, or 24%.